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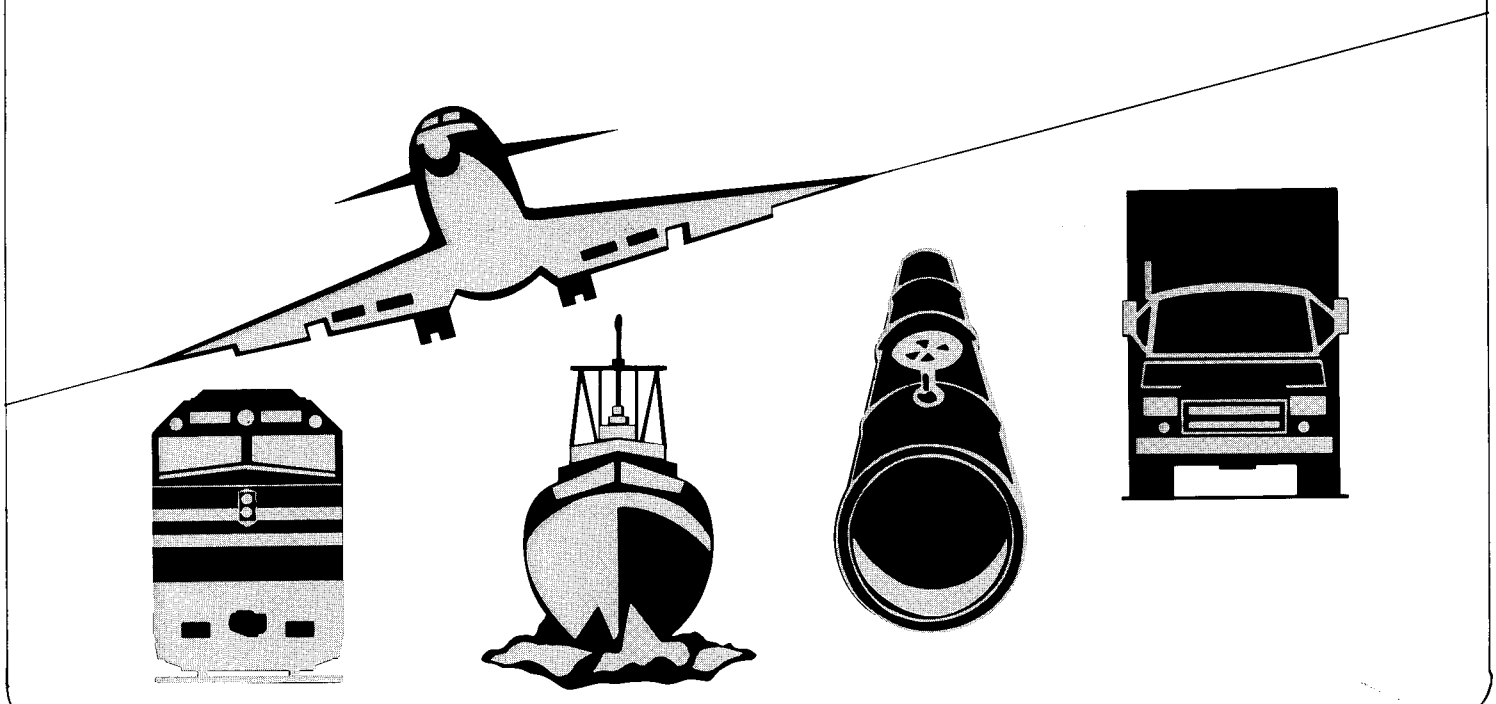
NATIONAL TRANSPORTATION SAFETY BOARD

SAFETY RECOMMENDATIONS
ADOPTED DURING THE MONTH OF JULY, 1999



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16. Abstract

This publication contains safety recommendations in aviation, highway and railroad modes of transportation adopted by the National Transportation Safety Board during the month of July, 1999.

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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 13, 1999

In reply refer to: A-99-51 through -54

Honorable Jane F. Garvey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On October 15, 1998, Delta Air Lines flight 915, a McDonnell Douglas MD-88, N902DE, experienced an uncontained failure[1] in the No. 2 (right) engine, a Pratt & Whitney (P&W) JT8D-219, immediately after takeoff from Logan International Airport, Boston, Massachusetts. The pilots reported that, just after takeoff, they felt a light thump, the airplane yawed to the right, and the cockpit instrumentation indicated that the No. 2 engine had lost power. The pilots then declared an emergency and returned to Boston. None of the 128 passengers, 4 flight attendants, and 2 pilots on board were injured. The airplane was operating on an instrument flight rules flight plan under the provisions of 14 Code of Federal Regulations Part 121 as a regularly scheduled passenger flight from Boston to Atlanta, Georgia.

The examination of the No. 2 engine revealed that the rear sections of the upper and lower forward cowl doors were deflected away from the engine and that the rear cowl doors were missing. The airplane's vertical stabilizer and fuselage adjacent to the No. 2 engine sustained minor damage from impact by the upper cowling. Subsequent disassembly of the engine revealed the combustion chamber outer case (CCOC) had ruptured axially from the fuel drain boss[2] at the bottom of the case.

The CCOC is a barrel-shaped structure that houses the combustion chambers and contains four circular-shaped bosses, mounted on which are two igniter plugs, a pressure port, and a fuel drain (see figure 1). The ruptured CCOC was assembled in six pieces: the front flange[3] and body, the four bosses, and the rear flange. The front flange and body of the case and the four bosses were made of AMS [Aerospace Material Specification] 5613 410 stainless steel,[4] and all of the

[1] An uncontained engine failure occurs when an internal part of the engine fails and is ejected through the cowling or causes other pieces of the engine to be ejected through the cowling.
[2] A boss is a raised or reinforced portion of a part onto which a smaller part is attached.
[3] A flange is a thin extension from an object that is used to attach that object to another.
[4] AMS 5613 410 stainless steel is an iron-based alloy with 0.12 percent carbon and 12.5 percent chromium.

pieces of the case were welded together using 410 stainless steel weld wire, as specified by the CCOC's engineering drawing.

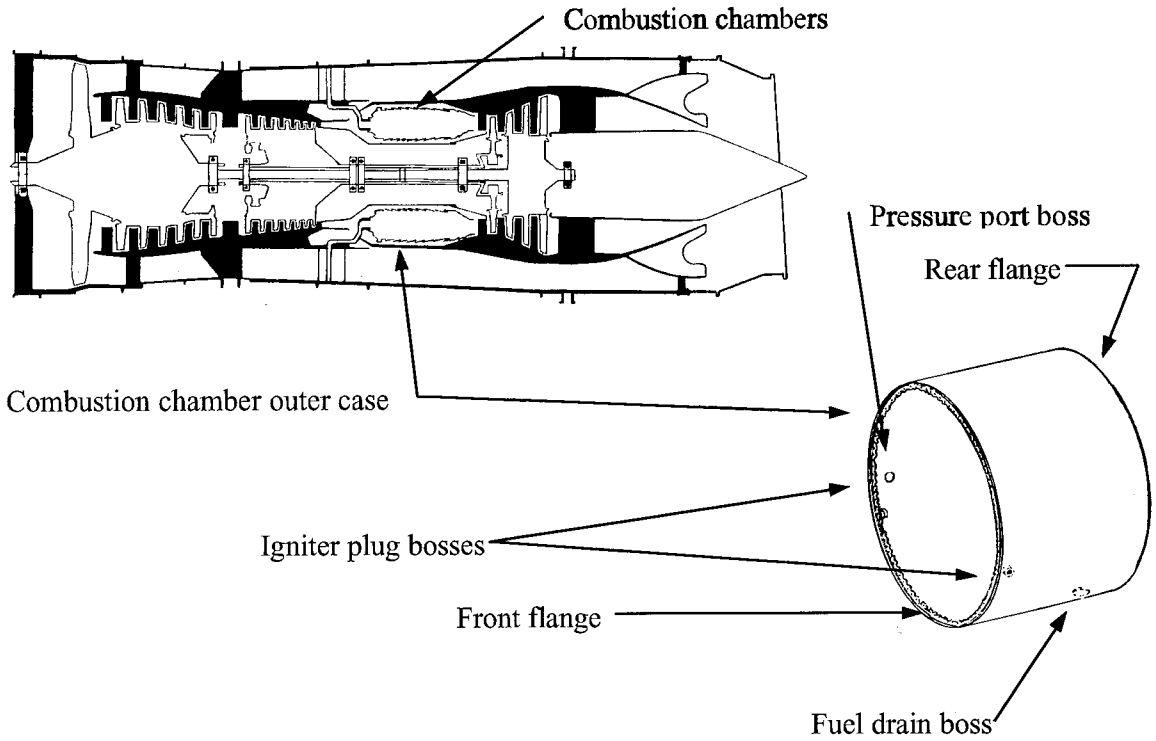

Figure 1. JT8D-200 engine cross section showing the location of the CCOC, and an enlarged view of the CCOC showing the location of the bosses and the case's front and rear flanges.

The ruptured CCOC was examined at the National Transportation Safety Board's materials laboratory. This examination revealed a fatigue fracture that had multiple origins along the weld on the exterior side of the fuel drain boss. The fracture had propagated about 150° around the boss and then axially, about 1½ inches forward and ½ inch rearward. The fatigue striations indicated that the crack had existed for approximately 1,340 cycles before the CCOC ruptured. The fracture originated from a mechanically thinned area of the boss' flange that had grinding marks consistent with previous work. The measured thickness of the boss flange adjacent to the fatigue fracture was 0.080 inch; however, the fuel drain boss' engineering drawing required a thickness of 0.099 to 0.109 inch.

The ruptured CCOC was manufactured by P&W in October 1986. Manufacturing records show that, after assembly, the CCOC was rejected twice during postwelding inspections because of crack indications and/or weld imperfections in two of the boss welds. The CCOC was reworked[5] by P&W after each rejection, and the part was accepted after its third inspection.

[5]According to the P&W JT8D-200 Engine Manual Section 72-41-11, Repairs -02, -03, and -07, the procedure for repairing or reworking a CCOC that has crack indications or imperfections in a boss weld is to use a grinder to

Delta Air Lines' maintenance records show that the ruptured CCOC had been in service for 28,502.6 hours and 24,294 cycles since new and that the CCOC had been installed on the engine in May 1995 during the last overhaul, 9,084.9 hours and 6,978 cycles before the rupture occurred. The records show that the CCOC, before installation on the engine, had undergone fluorescent penetrant and magnetic particle inspections with no cracks noted. The records do not show any weld repairs to the ruptured CCOC's bosses. Because the metallurgical examination revealed that the cracking initiated approximately 1,340 cycles before the rupture, the Safety Board concludes that the crack had not initiated at the time of Delta's May 1995 engine overhaul.

Although this CCOC rupture was the first to occur on a JT8D-200 engine, the JT8D-1 through -17AR engines, which have a CCOC that is very similar to the JT8D-200 CCOC,[6] have had at least 10 CCOC ruptures that initiated from boss welds and at least 9 others from rear flange bolt holes.[7] Because of the history of CCOC ruptures and cracking, the Federal Aviation Administration (FAA) issued a series of airworthiness directives (AD), including AD 96-23-14, which mandates repetitive on-wing eddy current and ultrasonic inspections of the JT8D-1 through -17AR CCOC bosses and rear flange. The Safety Board notes that P&W developed one-piece CCOCs that have thicker flanges and integral bosses for the JT8D-1 through -17AR and JT8D-200 engines. Because these bosses are not welded in, the boss weld from the area where the cracks that led to ruptures were initiating would thus be eliminated for engines with the one-piece case. Therefore, the Safety Board believes that the FAA should require that all P&W JT8D-1 through -17AR and JT8D-200 engines have a one-piece, integral boss CCOC installed at the next shop visit that the engine's CCOC becomes accessible.

Because of the size of the JT8D-1 through -17AR and JT8D-200 operating fleet, it will be several years until all of the engines are retrofitted with the one-piece, integral boss CCOC. Thus, interim actions are also needed.

Because the maintenance records indicated that Delta did not accomplish any weld repairs to the ruptured CCOC, the Safety Board concludes that the grinding adjacent to the weld that thinned the fuel drain boss flange was done by P&W during its rework of the CCOC.[8] The Safety Board is concerned that other JT8D-1 through -17AR and JT8D-200 CCOCs that were reworked during manufacture may have been accepted with a below-minimum thickness case wall or boss flange from which a crack could initiate and propagate to rupture. Therefore, the Safety Board believes that the FAA should require, as an interim action, P&W to identify all JT8D-1 through -17AR and JT8D-200 engine CCOCs that had boss welds reworked during manufacture; require repetitive on-wing inspections of those CCOCs for boss weld cracks at intervals appropriately less than 1,340 cycles in service; and, if cracks are found, require the removal of those engines from

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rout out the area of the indication or imperfection and adjacent weld material before rewelding the part. The repair procedures further state that the material adjacent to the weld must not be reduced.

[6] The JT8D-1 through -17AR and JT8D-200 engines are type certificated separately.

[7] FAA Service Difficulty Report (SDR) data identified only 5 of the at least 19 CCOC ruptures on JT8D-1 through -17AR engines. The Safety Board has frequently found that the SDR database does not capture many reportable events.

[8] Although P&W's acceptance in 1986 of a CCOC with a below-minimum thickness boss flange raises questions about the adequacy of its postmanufacturing inspection procedures at that time, this issue is no longer relevant because P&W is currently producing only the one-piece, integral boss CCOC.

service for replacement of the CCOC. Periodic inspections should continue until a one-piece, integral boss CCOC is installed.

The Safety Board notes that, as a result of the CCOC rupture incident, Delta Air Lines developed an on-wing procedure to inspect all of its JT8D-200 engines that have a similar CCOC to the one that ruptured. Delta found that eight CCOCs had cracks in the boss welds and reported that all of these CCOCs were removed from service. In addition, during shop inspections, Delta found four other CCOCs that had cracks around the boss welds. According to Delta, a visual inspection of these 12 cases did not reveal any evidence of mechanical thinning adjacent to the crack,[9] as was found on the CCOC that ruptured.

On March 31, 1999, P&W issued Alert Service Bulletin (ASB) JT8D A6359 (effective May 1, 1999), which calls for an initial on-wing inspection procedure for JT8D-200 CCOC fuel drain boss weld cracks.[10] However, an ASB is only a recommendation by a manufacturer to the operators and therefore does not require that the action be accomplished, as would be the case if the action were contained in an FAA AD. P&W stated that, as of May 13, 1999, it had not received any reports from JT8D-200 operators of CCOC inspections accomplished in accordance with ASB JT8D A6359 or occurrences of CCOC cracking.

The Safety Board has no reason to believe that Delta's findings from its on-wing inspection procedure would be atypical of the remainder of the JT8D-200 engine fleet. As previously stated, it will be several years before all of the affected JT8D-200 engines can be disassembled to permit the installation of a one-piece, integral boss CCOC. Therefore, the Safety Board believes that the FAA should require, as an interim action for those P&W JT8D-200 engine CCOCs that did not have the boss welds reworked during manufacture, repetitive on-wing inspections of the bosses at appropriate intervals for cracks in the welds and, if cracks are found, require the removal of those engines from service for replacement of the CCOC. Periodic inspections should continue until a one-piece, integral boss CCOC is installed.

In addition, Delta reported that its inspections found four CCOCs with nonmagnetic bosses. Because 410 stainless steel is magnetic, this finding indicates that those CCOC bosses were manufactured with an alternate material, the properties of which were not evaluated for the design and certification of the CCOC. In ASB JT8D A6359, P&W stated that the use of this alternate material is likely to reduce the crack propagation life. Therefore, the Safety Board believes that the FAA should require a one-time inspection to identify any P&W JT8D-1 through -17AR and JT8D-200 CCOCs with nonmagnetic bosses. If such bosses are found, require the removal of those engines from service for replacement of the CCOC with a one-piece, integral boss CCOC.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

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[9] The cycles since new for the 12 CCOCs with cracks ranged from 15,724 to 24,805, and the cycles since last inspection ranged from 5,575 to 11,799.

[10] The ASB stated that recurring inspection intervals for the fuel drain boss and initial and recurring inspections for the pressure port boss would be provided in a forthcoming ASB.

Require that all Pratt & Whitney JT8D-1 through -17AR and JT8D-200 engines have a one-piece, integral boss combustion chamber outer case (CCOC) installed at the next shop visit that the engine's CCOC becomes accessible. (A-99-51)

Require, as an interim action, Pratt & Whitney to identify all JT8D-1 through -17AR and JT8D-200 engine combustion chamber outer cases (CCOC) that had boss welds reworked during manufacture; require repetitive on-wing inspections of those CCOCs for boss weld cracks at intervals appropriately less than 1,340 cycles in service; and, if cracks are found, require the removal of those engines from service for replacement of the CCOC. Periodic inspections should continue until a one-piece, integral boss CCOC is installed. (A-99-52)

Require, as an interim action for those Pratt & Whitney JT8D-200 engine combustion chamber outer cases (CCOC) that did not have the boss welds reworked during manufacture, repetitive on-wing inspections of the bosses at appropriate intervals for cracks in the welds and, if cracks are found, require the removal of those engines from service for replacement of the CCOC. Periodic inspections should continue until a one-piece, integral boss CCOC is installed. (A-99-53)

Require a one-time inspection to identify any Pratt & Whitney JT8D-1 through -17AR and JT8D-200 combustion chamber outer cases (CCOC) with nonmagnetic bosses. If such bosses are found, require the removal of those engines from service for replacement of the CCOC with a one-piece, integral boss CCOC. (A-99-54)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: 
Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 6, 1999

In reply refer to: H-99-20 and -21

Honorable Donna E. Shalala
U.S. Department of Health and Human Services
200 Independence Avenue, SW
Washington, DC 20201

In 1999, the National Transportation Safety Board initiated a special investigation as a result of its findings from four recent accidents involving "nonconforming buses," that is, vehicles for student transportation that meet the Federal definition of a bus[1] but not the Federal occupant crash protection standards of school buses.[2] In the subject accidents, 9 people were killed, and 36 were injured. One of the accidents investigated occurred on December 8, 1998, in East Dublin, Georgia, when a 15-passenger van transporting children to a Head Start program collided with a pickup truck. During the accident sequence, a 4-year-old child was ejected from the van and sustained fatal injuries. The van driver sustained serious injuries; the adult aide and remaining four children sustained minor injuries. The van was owned and operated by the Laurens County Rural Transit System.

The nonconforming bus involved in the East Dublin accident did not and was not required to meet Federal school bus occupant crash protection standards, which were enacted in the 1970s for the specific purpose of safeguarding children being transported to and from school or school-related activities. The States, which are responsible for enforcing the use of school buses, in most cases, require that children be transported to and from school only on buses meeting Federal school bus crashworthiness standards. However, despite clear directives to the contrary from the National Highway Traffic Safety Administration (NHTSA) and national associations, some States by statutory exclusion or exception either allow or do not prohibit the use of nonconforming buses to school-related activities, including Head Start programs.

In 1977, NHTSA issued an interpretation letter in a response to an inquiry as to whether Head Start facilities are considered preprimary schools for purposes of applying the Federal school bus safety standards. The letter reads, in part:

[1] FMVSS (CFR 571.3) defines *bus* as a motor vehicle designed to carry more than 10 persons and *school bus* as a bus that carries students to or from school or school-related activities.

[2] For additional information, refer to Special Investigation Report—*Pupil Transportation in Vehicles Not Meeting Federal School Bus Standards* (NTSB/SIR-99/02).

> [NHTSA] has determined that these [Head Start] facilities are primarily involved with the education of preprimary school children. Thus, the buses used to transport children to and from the Head Start facilities are considered school buses...and must meet all Federal school bus safety standards.

For its special investigation report, the Safety Board reviewed a February 1999 survey conducted by the National Association of State Directors of Pupil Transportation Services. Of the 32 directors responding, 20 said that their States permitted the use of nonconforming vans for Head Start transportation; only 8 States specifically prohibited using vehicles other than school buses to transport Head Start children.[3]

The Safety Board is disturbed by the trend toward using nonconforming vehicles rather than school buses in pupil transportation. When States allow children to be transported in vehicles not meeting Federal school bus construction standards, NHTSA's intent of protecting school children is undermined. This trend is potentially serious in that it puts children at greater risk of fatal or serious injury in the event of an accident. The Safety Board is firmly convinced that the best way to maximize pupil transportation safety is to require the use of school buses or buses built to equivalent occupant crash protection standards.

In 1995, the Head Start Bureau issued a notice of proposed rulemaking (NPRM) to establish required safety features and operating procedures for any vehicle, including all buses, used to transport children to Head Start programs. The NPRM proposes that the transport of Head Start children be limited to school buses. The release of this rulemaking should be expedited to prevent future injuries and fatalities to children enrolled in Head Start programs.

The Safety Board is aware that in February 1999, NHTSA published the *Guideline for the Safe Transportation of Pre-School Age Children in School Buses*, which recommends that preschool-age children be transported in child safety restraint systems on school buses. Because Head Start children are primarily preschool age, the Safety Board believes that the DHHS should incorporate and mandate the use of the guidelines from this NHTSA publication into its rules for the transportation of Head Start children.

The Safety Board therefore recommends that the U.S. Department of Health and Human Services:

> Require that Head Start children be transported in vehicles built to Federal school bus structural standards or the equivalent. (H-99-20)

> Incorporate and mandate the use of the guidelines from the National Highway Traffic Safety Administration's *Guideline for the Safe Transportation of Pre-school Age Children in School Buses* into the rules for the transportation of Head Start children. (H-99-21)

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[3] The total number of responses to some questions varied because some State directors did not answer all survey inquiries.

Also, the Safety Board issued safety recommendations to the Governors of the U.S. States and Territories, the Mayor of the District of Columbia, the National School Boards Association, the National Association of Independent Schools, the National Conference on School Transportation, the National Parent Teacher Association, the National Association of Child Care Professionals, the National Child Care Association, the National Head Start Association, the Young Men's Christian Association, the Young Women's Christian Association, the national headquarters of 14 major churches, and the Community Transportation Association of America.

Please refer to Safety Recommendations H-99-20 and -21 in your reply. If you need additional information, you may call (202) 314-6444.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 6, 1999

In reply refer to: H-99-22 through -24

See Distribution

In 1999, the National Transportation Safety Board initiated a special investigation as a result of its findings from four accidents in 1998 and 1999 involving "nonconforming buses," that is, vehicles for student transportation that meet the Federal definition of a bus[1] but not the Federal occupant crash protection standards of school buses.[2] In the subject accidents, summarized below, 9 people were killed, and 36 were injured.

On March 25, 1998, in Sweetwater, Florida, a 15-passenger van hired by parents to take children to and from school collided with a transit bus. Three children were ejected and sustained head injuries. On March 26, 1998, in Lenoir City, Tennessee, a 25-passenger specialty bus[3] taking children from a school-related activity collided with a truck tractor semitrailer. Two people, one of whom was ejected, were fatally injured. On December 8, 1998, in East Dublin, Georgia, a 15-passenger van transporting children to a Head Start program collided with a pickup truck. One child was ejected and fatally injured. On February 16, 1999, in Bennettsville, South Carolina, a 15-passenger van transporting children home from an after-school church program was struck by a tow truck. Three children were ejected, and a total of six children were fatally injured.

The nonconforming buses involved in these accidents did not and were not required to meet Federal school bus occupant crash protection standards, which require that all school buses transporting children to and from school or school-related activities have roof rollover protection, energy-absorbing seats, and greater body joint strength than most other types of vehicles. Enactment of these Federal standards in the 1970s stemmed, in large part, from safety recommendations issued to the National Highway Traffic Safety Administration (NHTSA) by the Safety Board as a result of its investigation of a number of catastrophic school bus accidents. In these tragic cases, many children were killed or severely injured when the buses structurally collapsed or suffered joint failure during the accident sequences.

[1] FMVSS (CFR 571.3) defines *bus* as a motor vehicle designed to carry more than 10 persons and *school bus* as a bus that carries students to or from school or school-related activities.

[2] For additional information, refer to Special Investigation Report—*Pupil Transportation in Vehicles Not Meeting Federal School Bus Standards* (NTSB/SIR-99/02).

[3] *Specialty bus* is the industry term for the small buses that are commonly used as shuttle or tour buses. No Federal standard defines the names and configurations for buses of these sizes and types.

The Federal school bus crashworthiness standards have had an enormous impact on the safety of student transportation. According to a NHTSA fact sheet on school buses, the number of school bus passenger fatalities nationwide averages fewer than 10 each year out of approximately 10 billion student trips.[4]

NHTSA's Safety Program Guideline 17, *Pupil Transportation Safety*, establishes minimum recommendations for a State highway safety program for pupil transportation. Guideline 17 recommends that buses meeting the Federal structural standards for school buses be used for transporting children to and from school or school-related activities. A 1997 NHTSA interpretation letter states that because Head Start facilities are primarily involved with the education of preprimary school children, the buses used to transport children to and from the facilities "are considered school buses...and must meet all Federal school bus safety standards." A 1998 NHTSA interpretation letter regarding the use of buses transporting children between schools and publicly or privately owned day care centers states that if the bus is "used significantly"[5] to transport children to or from school or a school-related event, the vehicle must meet the Federal school bus safety standards.

The States, which are responsible for enforcing the use of school buses, in most cases, require that children be transported to and from school only on buses meeting Federal school bus crashworthiness standards. Some States, however, by statutory exclusion or exception either allow or do not prohibit the use of nonconforming buses to school-related activities, including Head Start programs and day care facilities. The guidelines to the States and to the transportation industry from Federal agencies and national associations clearly state that vehicles built to school bus standards should be used for these activities.

For its special investigation report, the Safety Board reviewed a February 1999 survey conducted by the National Association of State Directors of Pupil Transportation Services (NASDPTS). Of the 32 directors responding, only 26 directors said that their States prohibit the use of nonconforming vans to transport children to and from school; 6 directors said that their States had no such prohibitions. Regarding the transport of children to and from school-related activities, 19 States prohibit the use of nonconforming vans, and 13 do not. Twenty States currently permit the use of nonconforming vans for Head Start transportation, while eight do not.[6] Twenty-three States allow the use of vans in day care centers, and six do not.

NASDPTS states in a recent position paper, "We believe that it is appropriate to require higher levels of safety in vehicles that transport children to and from school and school-related activities." NASDPTS further states that "school children should be transported in school buses which provide them with the highest levels of safety, not in vans which do not meet the stringent school bus safety standards issued by the Federal Government."

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[4] The number of student trips was obtained from a January 1999 position paper of the National Association of State Directors of Pupil Transportation.

[5] In the case that resulted in the letter of interpretation, the van was transporting students (not necessarily the same students) 5 days a week.

[6] The total number of responses to some questions varies because some State directors did not answer all survey inquiries.

The Safety Board is disturbed by the trend toward using nonconforming vehicles rather than school buses in pupil transportation. When States and various school systems allow children to be transported in vehicles not meeting Federal school bus construction standards, they put children at greater risk of fatal or serious injury in the event of an accident. The Safety Board is firmly convinced that the best way to maximize pupil transportation safety is to require the use of school buses or buses built to equivalent occupant crash protection standards.

In February 1999, based on testing that it had conducted, NHTSA published *Guideline for the Safe Transportation of Pre-school Age Children in School Buses*, which recommends that preschool-age children be transported in child safety restraint systems. The Safety Board agrees that the use of child restraint systems can improve the survivability and lessen the chances of severe injury for students in small buses. All bus operators who transport preschool-aged children should therefore be made aware of and encouraged to comply with NHTSA's guideline.

The Safety Board recognizes that, although safety-conscious schools and organizations will increasingly replace nonconforming buses with school buses, vehicles not meeting the occupant crash protection standards of school buses will be used for pupil transport until laws stipulate otherwise. It is therefore particularly essential that operators of all vehicles equipped with occupant restraints ensure that students wear the age-appropriate restraint. In the three accidents mentioned earlier involving 15-passenger vans, had the passengers been wearing appropriate restraints, most of those who died probably would have survived and most of those who were injured probably would have sustained less severe injuries.

The Safety Board reviewed the current seat belt laws of several States and noted that some have allowable exclusions or exemptions pertaining to safety restraint use in buses for pupil transportation. These allowable exclusions and exemptions put students at great risk of fatal or serious injury in the event of an accident.

The Safety Board therefore recommends that the States, Territories, and the District of Columbia:

> Require that all vehicles carrying more than 10 passengers (buses) and transporting children to and from school and school-related activities, including, but not limited to, Head Start programs and day care centers, meet the school bus structural standards or the equivalent as set forth in 49 *Code of Federal Regulations* Part 571. Enact regulatory measures to enforce compliance with the revised statutes. (H-99-22)
>
> Review your State and local laws and, if applicable, revise to eliminate any exclusions or exemptions pertaining to the use of age-appropriate restraints in all seat belt equipped vehicles carrying more than 10 passengers (buses) and transporting school children. (H-99-23)
>
> Adopt the National Highway Traffic Safety Administration's *Guideline for the Safe Transportation of Pre-school Age Children in School Buses*, distribute the guideline to all school bus operators transporting preschool-age children to and

from school or school-related activities, and encourage those operators to implement the guideline. (H-99-24)

Also, the Safety Board issued Safety Recommendations to the Department of Health and Human Services, the National School Boards Association, the National Association of Independent Schools, the National Conference on School Transportation, the National Parent Teacher Association, the National Association of Child Care Professionals, the National Child Care Association, the National Head Start Association, the Young Men's Christian Association, the Young Women's Christian Association, the national headquarters of 14 major churches, and the Community Transportation Association of America.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations H-99-22 through -24 in your reply. If you need additional information, you may call (202) 314-6444.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Jim Hall
Chairman

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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 6, 1999
In reply refer to: H-99-25

See Distribution

In 1999, the National Transportation Safety Board initiated a special investigation[1] based on its findings in four recent accidents involving "nonconforming buses," that is, vehicles that meet the Federal definition of a bus,[2] that are used for pupil transportation, and that do not meet the Federal occupant crash protection standards for school buses. In the subject accidents, summarized below, 9 people were killed, and 36 were injured.

On March 25, 1998, in Sweetwater, Florida, a 15-passenger van hired by parents to take children to and from school collided with a transit bus. Three children were ejected and sustained head injuries. On March 26, 1998, in Lenoir City, Tennessee, a 25-passenger specialty bus[3] taking children from a school-related activity collided with a truck tractor semitrailer. Two people, one of whom was ejected, were fatally injured. On December 8, 1998, in East Dublin, Georgia, a 15-passenger van transporting children to a Head Start program collided with a pickup truck. One child was ejected and fatally injured. On February 16, 1999, in Bennettsville, South Carolina, a 15-passenger van transporting children home from an after-school church program was struck by a tow truck. Three children were ejected, and a total of six children were fatally injured.

The nonconforming buses involved in these accidents did not and were not required to meet Federal school bus occupant crash protection standards, which require that all school buses transporting children to and from school or school-related activities have roof rollover protection, energy-absorbing seats, and greater body joint strength than most other types of vehicles. Enactment of these Federal standards in the 1970s stemmed, in large part, from safety recommendations issued to the National Highway Traffic Safety Administration (NHTSA) by the Safety Board as a result of its investigation of a number of catastrophic school bus accidents. In these tragic cases, many children were killed or severely injured when the buses structurally collapsed or suffered joint failure during the accident sequences.

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[1] For additional information, refer to Special Investigation Report—*Pupil Transportation in Vehicles Not Meeting Federal School Bus Standards* (NTSB/SIR-99/02).

[2] The *Code of Federal Regulations* at Part 571.3 defines *bus* as a motor vehicle designed to carry more than 10 persons and *school bus* as a bus that carries students to or from school or school-related activities.

[3] *Specialty bus* is the industry term for the small buses that are commonly used as shuttle or tour buses. Presently, no Federal standard defines the names and configurations for buses of these sizes and types.

The Federal Government regulates the standards to which vehicles must be built, but the States mandate what type of vehicle should be used to transport school children. For the most part, the States require that children be transported to and from school only on buses meeting Federal school bus crashworthiness standards. However, some States by statutory exclusion or exception either allow or do not prohibit the use of nonconforming buses to school-related activities, Head Start programs, and day care centers. The guidelines for the States and for the transportation industry from Federal agencies and national associations clearly state that vehicles built to school bus standards should be used for these activities.

NHTSA's Safety Program Guideline 17, *Pupil Transportation Safety*, establishes minimum recommendations for a State highway safety program for pupil transportation. Guideline 17 recommends that buses meeting the Federal structural standards for school buses be used for transporting children to and from school or school-related activities. A 1997 NHTSA interpretation letter states that because Head Start facilities are primarily involved with the education of preprimary school children, the buses used to transport children to and from the facilities "are considered school buses...and must meet all Federal school bus safety standards." A 1998 NHTSA interpretation letter regarding the use of buses transporting children between schools and publicly or privately owned day care centers states that if the bus is "used significantly"[4] to transport children to or from school or a school-related event, the vehicle must meet the Federal school bus safety standards.

The Head Start Bureau issued a notice of proposed rulemaking (NPRM) in 1995 to establish required safety features and operating procedures for any vehicle, including all buses, used to transport children to Head Start programs. The NPRM proposes that the transport of Head Start children be limited to school buses.

The National Association of State Directors of Pupil Transportation Services (NASDPTS) states in a recent position paper, "We believe that it is appropriate to require higher levels of safety in vehicles that transport children to and from school and school-related activities." NASDPTS further states that "school children should be transported in school buses which provide them with the highest levels of safety, not in vans which do not meet the stringent school bus safety standards issued by the Federal Government."

For its special investigation report, the Safety Board reviewed a February 1999 NASDPTS survey. Of the 32 directors responding, only 26 directors said that their States prohibit the use of nonconforming vans to transport children to and from school; 6 directors said that their States had no such prohibitions. Regarding the transport of children to and from school-related activities, 19 States prohibit the use of nonconforming vans, and 13 do not. Twenty states currently permit the use of nonconforming vans for Head Start transportation, while eight do not.[5] Twenty-three States allow the use of vans in day care centers, and six do not.

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[4] In the case that resulted in the letter of interpretation, the van was transporting students (not necessarily the same students) 5 days a week.

[5] The total number of responses to some questions varies because some State directors did not answer all survey inquiries.

The Safety Board is disturbed by the trend toward using nonconforming vehicles rather than school buses in pupil transportation. When children are transported in vehicles not meeting Federal school bus construction standards, they are at greater risk of fatal or serious injury in the event of an accident. The Safety Board is firmly convinced that the best way to maximize pupil transportation safety is to ensure that all vehicles carrying more than 10 passengers (buses) and transporting children to and from school and school-related activities, including, but not limited to Head Start programs and day care centers, meet the school bus structural standards or the equivalent as set forth in 49 *Code of Federal Regulations* Part 571.

A number of national associations and churches (see attached distribution list) because of their involvement in education, transportation, or youth development are in unique positions to promote the use of school buses. The Safety Board believes that, pending the enactment of regulatory requirements, these associations and churches can help to maximize safety in pupil transportation.

The Safety Board therefore recommends that these associations and churches:

Inform their members about the circumstances of the accidents discussed in this special investigation report and urge that they use school buses or buses having equivalent occupant protection to school buses to transport children. (H-99-25)

Also, the Safety Board issued safety recommendations to the U.S. Department of Health and Human Services, the Governors of the U.S. States and Territories, the Mayor of the District of Columbia, and the Community Transportation Association of America.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation H-99-25 in your reply. If you need additional information, you may call (202) 314-6444.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall
Chairman

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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 6, 1999

In reply refer to: H-99-26

Mr. Dale Marsico
Executive Director
Community Transportation Association of America
1341 G Street, NW, Suite 600
Washington, DC 20005

In 1999, the National Transportation Safety Board initiated a special investigation as a result of its findings from four recent accidents involving "nonconforming buses," that is, vehicles for student transportation that meet the Federal definition of a bus[1] but not the Federal occupant crash protection standards of school buses.[2] In the subject accidents, 9 people were killed, and 36 were injured. One of the accidents investigated occurred on December 8, 1998, in East Dublin, Georgia, when a 15-passenger van transporting children to a Head Start program collided with a pickup truck. During the accident sequence, a 4-year-old child was ejected from the van and sustained fatal injuries. The van driver sustained serious injuries; the adult aide and remaining four children sustained minor injuries. The van was owned and operated by the Laurens County Rural Transit System.

The nonconforming bus involved in the East Dublin accident did not and was not required to meet Federal school bus occupant crash protection standards, which require that all school buses transporting children to and from school or school-related activities have roof rollover protection, energy-absorbing seats, and greater body joint strength than most other types of vehicles. Enactment of these Federal standards in the 1970s stemmed, in large part, from recommendations issued to the National Highway Traffic Safety Administration (NHTSA) by the Safety Board as a result of its investigation of a number of catastrophic school bus accidents. In these tragic cases, many children were killed or severely injured when the buses structurally collapsed or suffered joint failure during the accident sequences.

The States, which are responsible for enforcing the use of school buses, in most cases, require that children be transported to and from school only on buses meeting Federal school bus crashworthiness standards. However, despite clear guidelines to the contrary from NHTSA and

[1] The *Code of Federal Regulations* at Part 571.3 defines *bus* as a motor vehicle designed to carry more than 10 persons and *school bus* as a bus that carries students to or from school or school-related activities.

[2] For additional information, refer to Special Investigation Report—*Pupil Transportation in Vehicles Not Meeting Federal School Bus Standards* (NTSB/SIR-99/02).

national associations, some States by statutory exclusion or exception either allow or do not prohibit the use of nonconforming buses to school-related activities, including Head Start programs.

In 1977, NHTSA issued an interpretation letter in a response to an inquiry as to whether Head Start facilities are considered preprimary schools for purposes of applying the Federal school bus safety standards. The letter reads, in part:

> [NHTSA] has determined that these [Head Start] facilities are primarily involved with the education of preprimary school children. Thus, the buses used to transport children to and from the Head Start facilities are considered school buses...and must meet all Federal school bus safety standards.

In 1995, the Head Start Bureau issued a notice of proposed rulemaking (NPRM) to establish required safety features and operating procedures for any vehicle, including all buses, used to transport children to Head Start programs. The NPRM proposes that the transport of Head Start children be limited to school buses.

In Georgia, the State law[3] requires that children be transported to and from school and church in a school bus meeting specifications prescribed by the State Board of Education. However, Head Start transportation is not addressed in the specifications because the program is not within the purview of the Georgia State Board of Education. Thus, by exclusion, Georgia law allows the use of a nonconforming van to transport children from school to a Head Start facility despite NHTSA's interpretation that Head Start is an educational program and, as such, children enrolled in the program should be transported in school buses to and from the centers. The State exclusion is also contrary to the national Head Start Bureau's proposal that the transport of Head Start children be limited to school buses.

For its special investigation report, the Safety Board reviewed a February 1999 survey conducted by the National Association of State Directors of Pupil Transportation Services. Of the 32 directors responding, 20 said that their States permitted the use of nonconforming vans for Head Start transportation; only 8 States specifically prohibited using vehicles other than school buses to transport Head Start children.[4]

The Safety Board is disturbed by the trend toward using nonconforming vehicles rather than school buses in pupil transportation. When States and various school systems allow children to be transported in vehicles not meeting Federal school bus construction standards, the Federal intent of protecting school children is undermined. This trend is potentially serious in that it puts children at greater risk of fatal or serious injury in the event of an accident. The Safety Board is firmly convinced that the best way to maximize pupil transportation safety is to require the use of school buses or buses built to equivalent occupant crash protection standards. According to a

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[3] Georgia Official Code, Section 40-8-112.

[4] The total number of responses to some questions varied because some State directors did not answer all survey inquiries.

NHTSA fact sheet on school buses, the number of school bus passenger fatalities nationwide averages fewer than 10 each year out of approximately 10 billion student trips.[5]

Based on the Community Transportation Association of America's (CTAA's) mission of enabling mobility for people at risk of being unable to provide or afford their own transportation and given your association's network of community-based agencies and coordinated services, the Safety Board believes that the CTAA can take an active role in improving the safe transportation of children enrolled in Head Start programs.

The Safety Board therefore recommends that the Community Transportation Association of America:

> Inform your members of the circumstances of the East Dublin, Georgia, accident and of the added safety benefits of transporting children by school bus, and encourage them to use buses built to Federal school bus structural standards or equivalent to transport children. (H-99-26)

Also, the Safety Board issued Safety Recommendations to the Department of Health and Human Services, the Governors of the U.S. States and Territories, the Mayor of the District of Columbia, the National School Boards Association, the National Association of Independent Schools, the National Conference on School Transportation, the National Parent Teacher Association, the National Association of Child Care Professionals, the National Child Care Association, the National Head Start Association, the Young Men's Christian Association, the Young Women's Christian Association, and the national headquarters of 14 major churches.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation H-99-26 in your reply. If you need additional information, you may call (202) 314-6444.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall
Chairman

[5] The number of student trips was obtained from a January 1999 position paper of the National Association of State Directors of Pupil Transportation.

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: JUL 16 1999

In reply refer to: R-99-3

Honorable Jolene M. Molitoris
Administrator
Federal Railroad Administration
400 7th Street, S.W.
Washington, D.C. 20590

About 12:37 p.m. eastern daylight time on Saturday, June 20, 1998, 30 of the 148 cars making up eastbound CSX train Q316 derailed near Milepost (MP) 207.9 at Cox Landing, West Virginia. Of the derailed cars, three were loaded with hazardous material, and eight others contained hazardous material residue. Two of the loaded cars were damaged in the pileup and leaked a combined volume of about 21,500 gallons of formaldehyde solution. No one was injured during the derailment of the train; however, 15 persons reported minor injuries as a result of the release of formaldehyde. Total damages in the accident exceeded $2.6 million.[1]

The National Transportation Safety Board determined that the probable cause of this derailment was an unstable roadbed that resulted from the inadequate or ineffective measures taken by CSX Transportation, Inc., to permanently correct known drainage problems in the accident area.

Railroad track structure supports the weight of trains by distributing the load over a relatively wide area. The weight of the train is transferred from the rails to the crossties and from the crossties to the track ballast. The track ballast and subballast rest on the roadbed. Although different types of roadbed soil will react differently to an excessive amount of water, complete water saturation will generally destabilize a roadbed. To avoid such saturation, the track system, including ballast and subballast, must be able to guide both rain and drainage water away from the track structure. The track ballast allows water to drain through it, while the subballast should be impermeable, guiding water away from the subgrade and into the drainage ditches that parallel all railroad right-of-ways. These ditches are designed to flow water away from the track and toward culverts or terrain features that will channel the water away from the roadbed.

Before the accident, no culverts or other effective means of channeling water away from the track bed were located in the derailment area. According to statements from local residents, water stood in the ditches alongside the track until it either evaporated or soaked into the

[1] For more information, read Railroad Accident Report—*Derailment of a CSX Freight Train and Subsequent Hazardous Material Release at Cox Landing, West Virginia, June 20, 1998* (NTSB/RAR-99/01).

roadbed. At least partly because of the lack of effective drainage, the area in and around MP 207.9 had experienced instances of subgrade and surface problems, which had resulted in speed restrictions being placed on trackage in the derailment area. Track inspection records indicated that several locations near the derailment site had had track surface defects. In February 1998 and again in May 1998 (about 1 month before the accident), surface defects resulted in slow orders being issued for the accident area.

CSX was aware of and had attempted to address the roadbed instability in the vicinity of the derailment by adding ballast or other fill material. These measures, however, while temporarily effective, did not permanently solve the problem of roadbed instability, as indicated by the fact that in the area of the derailment, track inspectors noted numerous defects in cross level and curve elevation during the 12 months preceding the accident. In June 1998, the effects of inadequate drainage were exacerbated by above-average rainfall, which further contributed to roadbed saturation and made the roadbed even less able to maintain the integrity of the track geometry under load. With the roadbed thus weakened, the weight of trains passing through the area contributed to an irregular track surface. At some point, perhaps during the passage of train Q316 itself, the weakened subgrade allowed the cross level to degrade to the point that the cars passing through the area incurred a high degree of longitudinal roll. This rolling action would have decreased vertical force on the wheels on the outside rail of the curve and thus would have allowed, as happened in this accident, the flange of one or more wheels to "lift" and ride on top of the rail. The Safety Board therefore concluded that drainage in the accident area was inadequate and that, as a result, the roadbed in the derailment area likely became water-saturated, rendering the track structure unable to maintain track integrity under the load of train Q316.

While CSX added culverts and fill material to correct drainage problems, these measures may not address all the existing or potential drainage problems along the subdivision. Moreover, portions of the Ohio River Subdivision consist of lighter, older rail with observable, if relatively minor, defects in the form of head-checks. At least one of the several accidents that occurred on the subdivision before the Cox Landing derailment was caused by a broken rail. Also, some of the ties in the general area of the accident appeared to Safety Board investigators to be in poor condition. The Safety Board is concerned about these conditions, because the subdivision closely parallels the Ohio River, and the daily passage of two large trains carrying a variety of hazardous materials represents a significant risk to the river and the residents along it, should a derailment occur.

The Safety Board therefore made the following safety recommendation to CSX Transportation, Inc.:

> Perform a comprehensive engineering analysis and evaluation of track and roadbed conditions on the Ohio River Subdivision and develop a plan and a timetable for correcting existing or potential deficiencies, including inadequate drainage, that may affect the safe passage of trains and the safe shipment of hazardous materials through the area. Provide to the National Transportation Safety Board a schedule to correct the deficiencies found during the evaluation. (R-99-4)

The Safety Board is concerned about the recurring nature of the track and roadbed problems evident along portions of the CSX's Ohio River Subdivision and believes that focused Federal oversight of CSX performance in this area is not only justified but is necessary for the protection of people and the environment along this route.

Therefore, the National Transportation Safety Board makes the following safety recommendation to the Federal Railroad Administration:

> Review both the implementation and the management oversight of CSX Transportation's track inspection and maintenance programs for the Ohio River Subdivision and take the actions necessary to ensure the safe passage of trains and the safe shipment of hazardous materials through the area. (R-99-3)

Also, the Safety Board issued Safety Recommendations R-99-4 through -6 to CSX Transportation, Inc.; R-99-7 through -10 to Cabell and Wayne Counties' Local Emergency Planning Committee; and R-99-11 to Mountaineer Gas Company.

Please refer to Safety Recommendation R-99-3 in your reply. If you need additional information, you may call 202-314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: JUL 16 1999

In reply refer to: R-99-4 through -6

Mr. Pete Carpenter
President and Chief Executive Officer J-120
CSX Transportation, Inc.
Jacksonville General Office Building, 15th Floor
500 Water Street
Jacksonville, Florida 32202

About 12:37 p.m. eastern daylight time on Saturday, June 20, 1998, 30 of the 148 cars making up eastbound CSX train Q316 derailed at Cox Landing, West Virginia. Of the derailed cars, three were loaded with hazardous material, and eight others contained hazardous material residue. Two of the loaded cars were damaged in the pileup and leaked a combined volume of about 21,500 gallons of formaldehyde solution. No one was injured during the derailment of the train; however, 15 persons reported minor injuries as a result of the release of formaldehyde. Total damages in the accident exceeded $2.6 million.[1]

The National Transportation Safety Board determined that the probable cause of this derailment was an unstable roadbed that resulted from the inadequate or ineffective measures taken by CSX Transportation, Inc., to permanently correct known drainage problems in the accident area.

The investigation determined that the first wheel of train Q316 to derail was on the leading axle of the trailing truck of the 74th car on the train, car CCX 752. This determination was based on the fact that all wheels of the first 73 cars were on the track when the front portion of the train came to rest. Additionally, wheel marks visible on the crossties and on the center sill of CCX 752 indicated that this car had derailed first, as did the break in the top weld of the coupler carrier, which indicated that the car had dropped off the rails and continued, at least momentarily, while the following car remained on the rails.

The first wheel to derail climbed the east rail, which was the outside rail of the beginning of a 3° left-hand curve at MP 207.9. Following cars then derailed, and the train separated between the 77th and 78th cars. As the 78th car left the roadbed and plowed into a ditch, the cars following it, many of them containing hazardous materials, left the tracks and became involved in the general pileup.

[1] For more information, read Railroad Accident Report—*Derailment of a CSX Freight Train and Subsequent Hazardous Material Release at Cox Landing, West Virginia, June 20, 1998* (NTSB/RAR-99/01).

Car CCX 752 was carefully examined after the accident to determine if a mechanical defect in the car had caused the derailment. CSX inspectors partially disassembled the car and performed a detailed examination of car components in the presence of Safety Board and FRA representatives. The detailed inspection revealed no mechanical defect in the car.

On February 26, 1999, CCX 752 was involved in a second derailment about 33 miles from the first. Although the same car derailing twice in less than a year in the same relative area raises questions about the mechanical condition of the car, several important attributes of the car were different in the two derailments. Of major significance is that at the time of the second derailment, the car was loaded, as opposed to being empty at Cox Landing. Also, in the second derailment, the side bearing clearances were outside the recommended range, while investigators determined that the clearances at the time of the Cox Landing accident were within tolerance. Further, the second derailment occurred at a site of track surface deviations where special trackwork—a turnout and guardrail—complicated the track geometry. The Cox Landing derailment occurred at the beginning of a slight curve with no special trackwork. Finally, the second accident occurred after substantial work had been performed on the car, including replacing the wheel sets on the B-end and replacing a truck bolster and one side frame.

No inspections of car CCX 752 performed after the Cox Landing derailment and in the presence of Safety Board investigators and FRA representatives pinpointed any defect in the car that would have caused it to derail. Although this car is a covered hopper which, as a class of car, has a higher center of gravity when loaded and is more susceptible to being "rocked" off the rails than some other car types, no evidence was found after the Cox Landing accident to indicate that car CCX 752 was more likely to derail than other cars of its type. The Safety Board therefore concluded that the Cox Landing derailment was not caused by a mechanical defect in the empty covered hopper that was the first car to derail.

In addition to the mechanical condition of the rolling stock, the Safety Board investigation also addressed the condition of the roadbed in and near the accident area.

Railroad track structure supports the weight of trains by distributing the load over a relatively wide area. The weight of the train is transferred from the rails to the crossties and from the crossties to the track ballast. The track ballast and subballast rest on the roadbed. Although different types of roadbed soil will react differently to an excessive amount of water, complete water saturation will generally destabilize a roadbed. To avoid such saturation, the track system, including ballast and subballast, must be able to guide both rain and drainage water away from the track structure. The track ballast allows water to drain through it, while the subballast should be impermeable, guiding water away from the subgrade and into the drainage ditches that parallel all railroad right-of-ways. These ditches are designed to flow water away from the track and toward culverts or terrain features that will channel the water away from the roadbed.

Before the accident, no culverts or other effective means of channeling water away from the track bed were located in the derailment area. According to statements from local residents, water stood in the ditches alongside the track until it either evaporated or soaked into the roadbed. At least partly because of the lack of effective drainage, the area in and around MP 207.9 had experienced instances of subgrade and surface problems, which had resulted in speed

restrictions being placed on trackage in the derailment area. Track inspection records indicated that several locations near the derailment site had had track surface defects. In February 1998 and again in May 1998 (about 1 month before the accident), surface defects resulted in slow orders being issued for the accident area.

CSX was aware of and had attempted to address the roadbed instability in the vicinity of the derailment by adding ballast or other fill material. These measures, however, while temporarily effective, did not permanently solve the problem of roadbed instability, as indicated by the fact that in the area of the derailment, track inspectors noted numerous defects in cross level and curve elevation during the 12 months preceding the accident. In June 1998, the effects of inadequate drainage were exacerbated by above-average rainfall, which further contributed to roadbed saturation and made the roadbed even less able to maintain the integrity of the track geometry under load. With the roadbed thus weakened, the weight of trains passing through the area contributed to an irregular track surface. At some point, perhaps during the passage of train Q316 itself, the weakened subgrade allowed the cross level to degrade to the point that the cars passing through the area incurred a high degree of longitudinal roll. This rolling action would have decreased vertical force on the wheels on the outside rail of the curve and thus would have allowed, as happened in this accident, the flange of one or more wheels to "lift" and ride on top of the rail. The Safety Board therefore concluded that drainage in the accident area was inadequate and that, as a result, the roadbed in the derailment area likely became water-saturated, rendering the track structure unable to maintain track integrity under the load of train Q316.

While CSX added culverts and fill material to correct drainage problems, these measures may not address all the existing or potential drainage problems along the subdivision. Moreover, portions of the Ohio River Subdivision consist of lighter, older rail with observable, if relatively minor, defects in the form of head-checks. At least one of the several accidents that occurred on the subdivision before the Cox Landing derailment was caused by a broken rail. Also, some of the ties in the general area of the accident appeared to Safety Board investigators to be in poor condition. The Safety Board is concerned about these conditions, because the subdivision closely parallels the Ohio River, and the daily passage of two large trains carrying a variety of hazardous materials represents a significant risk to the river and the residents along it, should a derailment occur.

The Safety Board investigation also addressed emergency response after the accident. A derailed car struck the vertical riser on a residential gas meter located within 40 feet of the centerline of the tracks. Damage to the riser resulted in a gas leak that lasted for several hours. Gas service personnel were called, but they were not allowed to approach the damaged riser because of concern that the chlorine tank cars might also be leaking. However, because of concern about the gas leak itself, the incident commander directed gas company employees to shut off gas service in the immediate area at the site.

Without access to shut-off valves at the site, gas company employees were unable to repair the damaged riser or isolate the 2-inch line. As an alternative, pipeline personnel considered isolating the 6-inch gas main by closing shutoff valves, but they were concerned about the large number of residential and industrial customers that would be affected. In any event, because of the

location of the valves and the pressure and volume of gas in the line, blocking the 6-inch line would not have immediately stopped the leak.

The incident commander eventually allowed the gas service crew to access the damaged riser and determine if the 2-inch service line could be shut down. Following their inspection, the service crew capped the 2-inch service line, but the line remained charged with pressurized gas, since the line had not been isolated from the 6-inch main supply line.

Because railroad and gas company personnel did not coordinate their activities before railroad contractors began working in the area of the gas line, railroad contractors did not know that the gas line was still charged. They stated that, had they known, they would not have carried out the wreckage-clearing operations the next day that severed the gas line and created a second gas leak in the area. This released gas, if ignited, could have injured nearby recovery workers and destroyed or damaged property. Although the gas did not ignite, its release posed a safety hazard to those in the area. The Safety Board concluded that railroad wreckage-clearing operations and pipeline operations were not effectively coordinated and unified under an effective command structure,[2] which placed excavation personnel at risk while they worked in the vicinity of a natural gas line. A unified incident command structure would have ensured better commitment from and participation by railroad, pipeline, and public safety officials in decision-making throughout the emergency response, wreckage-clearing, and environmental remediation activities.

The need for increased communication and coordination between railroads and pipeline operators has been demonstrated in other Safety Board accident investigations.[3] In its investigation of an Amtrak passenger train derailment on CSX tracks near Intercession City, Florida, on November 30, 1993, the Safety Board concluded that the lack of a cooperative action plan between CSX and the pipeline operator contributed to a breakdown in communication during wreckage-clearing operations. After its investigation of the Intercession City accident, the Safety Board asked CSX, in Safety Recommendation R-95-32, to develop procedures for coordinating emergency response and wreckage-clearing operations with public safety officials to ensure that the actions of its employees and its contractors do not endanger personnel safety or the facilities of others on or adjacent to the railroad right-of-way. In its June 6, 1997, response, CSX stated that it had revised emergency response coordination policy to require that operations center personnel determine whether pipelines are likely to be in the area of any emergency. If they are, on-scene personnel must be notified of the possible existence of pipelines and must coordinate with the pipeline operators and public safety officials. On the basis of this response, Safety

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[2] See National Response Team Incident Command Technical Assistance Document: *Managing Response to Oil Discharge and Hazardous Substances Under the National Contingency Plan*, published by the National Response Team, May 1996. (Available at http://www.nrt.org)

[3] For example, see Railroad Accident Report—*Derailment of Southern Pacific Transportation Company Freight Train on May 12, 1989, and Subsequent Rupture of Calnev Petroleum Pipeline on May 25, 1989, at San Bernardino, California* (NTSB/RAR-90/02); Railroad Accident Report—*Atchison, Topeka and Santa Fe Railway Company (ATSF) Freight Trains ATSF 818 and ATSF 891 on the ATSF Railway, Corona, California, November 8, 1990* (NTSB/RAR-91/03); Highway Accident Report—*Collision of Amtrak Train No. 88 with Rountree Transport and Riggings, Inc., Vehicle on CSX Transportation, Inc., Railroad Near Intercession City, Florida, November 30, 1993* (NTSB/HAR-95/01); and Railroad Accident Report—*Derailment of Freight Train H-BALT1-31 Atchison, Topeka and Santa Fe Railway Company Near Cajon Junction, California, on February 1, 1996* (NTSB/RAR-96/05).

Recommendation R-95-32 was classified "Closed—Acceptable Alternative Action" on September 11, 1997.

Despite the CSX response to Safety Recommendation R-95-32, however, at least in the area of this accident, CSX did not have adequate procedures in place to facilitate the level of on-scene coordination necessary to have prevented putting railroad workers at risk during wreckage-clearing operations.

CSX records indicated that the company had a program of community outreach and emergency response training assistance for rail transportation accidents involving hazardous materials. According to CSX officials, on at least two occasions, in 1997 and 1998, the company offered to provide hazardous materials training to local emergency responders in the Cabell and Wayne County areas; however, these offers apparently received no response, with the result that no such CSX-sponsored training was conducted. The company gave no indication that CSX representatives made any follow-up effort when no response to its offer of training was made. CSX has, since the accident, developed an 8-hour advanced course for emergency responders, but this training is provided on an "as requested" basis.

In the view of the Safety Board, CSX should much more actively promote its company-sponsored hazardous materials training. More active promotion and better follow-up on offers of training would help ensure that local emergency responders are prepared for a railroad emergency. CSX benefits from the transportation of cargo, including hazardous materials, along the Ohio River Subdivision, and the company is acutely aware of the potential hazards to persons and the environment in the event of an accident involving its trains. The Safety Board therefore believes that CSX should examine its hazardous materials outreach program with the objective of ensuring that emergency response agencies are fully prepared for an emergency involving CSX trains.

Based on its investigation of this accident, the National Transportation Safety Board makes the following safety recommendations to CSX Transportation, Inc.:

> Perform a comprehensive engineering analysis and evaluation of track and roadbed conditions on the Ohio River Subdivision and develop a plan and a timetable for correcting existing or potential deficiencies, including inadequate drainage, that may affect the safe passage of trains and the safe shipment of hazardous materials through the area. Provide to the National Transportation Safety Board a schedule to correct the deficiencies found during the evaluation. (R-99-4)
>
> Develop and implement incident coordination procedures that will ensure that safety-critical operations during wreckage-clearing activities are coordinated with all parties involved in those activities. (R-99-5)
>
> Review and revise, as necessary, in light of this accident, your community outreach and training assistance programs to ensure that all emergency response groups that may be called upon to respond to an incident or accident involving your railroad receive the necessary training on a timely and recurring basis. (R-99-6)

Also, the Safety Board issued Safety Recommendations R-99-3 to the Federal Railroad Administration, R-99-7 through -10 to Cabell and Wayne Counties' Local Emergency Planning Committee, and R-99-11 to Mountaineer Gas Company.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-99-4 through -6 in your reply. If you need additional information, you may call 202-314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: JUL 16 1999

In reply refer to: R-99-7 through -10

Ms. Beth Richmond, Chairperson
Cabell/Wayne Local Emergency Planning Committee
750 5th Avenue, Suite 300
Cabell County Courthouse
Huntington, West Virginia 25701

About 12:37 p.m. eastern daylight time on Saturday, June 20, 1998, 30 of the 148 cars making up eastbound CSX train Q316 derailed at Cox Landing, West Virginia. Of the derailed cars, three were loaded with hazardous material, and eight others contained hazardous material residue. Two of the loaded cars were damaged in the pileup and leaked a combined volume of about 21,500 gallons of formaldehyde solution. No one was injured during the derailment of the train; however, 15 persons reported minor injuries as a result of the release of formaldehyde. Total damages in the accident exceeded $2.6 million.[1]

The local emergency responders were effective in identifying the immediate hazards and initiating an immediate evacuation of nearby residents. Also, after some delay, responders called in chemical specialists to assess each tank car for leakage and potential risk. The Safety Board investigation did, however, identify a need for additional planning, training, and communication among the agencies responding to the accident.

Cabell County was equipped with Operation Respond Emergency Information System (OREIS) software capable of printing out emergency response information, including the specific contents of affected cars and detailed information about the handling of any hazardous materials involved. Because the OREIS software was not used after the Cox Landing derailment (the train conductor was available to provide the information), the Safety Board could not evaluate its effectiveness in the response to this accident. In the view of the Safety Board, the software does appear to be a tool with potential for providing information that could be useful in the aftermath of a hazardous materials accident. In this case, however, because the C/WLEPC had not included use of the OREIS software in its disaster drills and had not updated its emergency response plan to include information about the system, responders on the scene were unaware of the existence or the capabilities of the OREIS system, and they had not been trained in its use. The Safety Board therefore concluded that the full potential of the Cabell County OREIS software could not be realized, or even evaluated by emergency responders, because of a lack of information about

[1] For more information, read Railroad Accident Report—*Derailment of a CSX Freight Train and Subsequent Hazardous Material Release at Cox Landing, West Virginia, June 20, 1998* (NTSB/RAR-99/01).

the system in Cabell and Wayne Counties' emergency response plan and because exercises involving the system were not included in periodic disaster drills.

The incident commander(s) in this accident were from the Ohio River Volunteer Fire Department (ORVFD), which had not participated in Cabell and Wayne Counties' periodic disaster drills. Even though the ORVFD maintained copies of the C/WLEPC emergency response plan, the incident commanders did not initiate the call for outside assistance that was directed in the plan. The Cabell County EMS director, who was familiar with the plan, did initiate a call, but because of the delay, individuals with special chemical expertise (the Dupont Chlorine Emergency Response Team) did not arrive on scene until about 3 hours after the derailment. Had the leaking chemicals been more hazardous than formaldehyde, this delay could have had serious consequences.

The Safety Board concluded that because the ORVFD had not participated in Cabell and Wayne Counties' disaster drills and because its officers were unfamiliar with the counties' emergency response plan, the incident commanders did not use all available resources to assist in the emergency.

In the accident, a derailed car struck the vertical riser on a residential gas meter located within 40 feet of the centerline of the tracks. Damage to the riser resulted in a gas leak that lasted for several hours. Gas service personnel were called, but they were not allowed to approach the damaged riser because of concern that the chlorine tank cars might also be leaking. However, because of concern about the gas leak itself, the incident commander directed gas company employees to shut off gas service in the immediate area at the site.

Without access to shut-off valves at the site, gas company employees were unable to repair the damaged riser or isolate the 2-inch line. As an alternative, pipeline personnel considered isolating the 6-inch gas main by closing shutoff valves, but they were concerned about the large number of residential and industrial customers that would be affected. In any event, because of the location of the valves and the pressure and volume of gas in the line, blocking the 6-inch line would not have immediately stopped the leak.

The incident commander eventually allowed the gas service crew to access the damaged riser and determine if the 2-inch service line could be shut down. Following their inspection, the service crew capped the 2-inch service line, but the line remained charged with pressurized gas, since the line had not been isolated from the 6-inch main supply line.

Because railroad and gas company personnel did not coordinate their activities before railroad contractors began working in the area of the gas line, railroad contractors did not know that the gas line was still charged. They stated that, had they known, they would not have carried out the wreckage-clearing operations the next day that severed the gas line and created a second gas leak in the area. This released gas, if ignited, could have injured nearby recovery workers and destroyed or damaged property. Although the gas did not ignite, its release posed a safety hazard to those in the area. The Safety Board concluded that railroad wreckage-clearing operations and pipeline

operations were not effectively coordinated and unified under an effective command structure,[2] which placed excavation personnel at risk while they worked in the vicinity of a natural gas line. A unified incident command structure would have ensured better commitment from and participation by railroad, pipeline, and public safety officials in decision-making throughout the emergency response, wreckage-clearing, and environmental remediation activities.

Based on its investigation of this accident, the National Transportation Safety Board makes the following safety recommendations to Cable and Wayne Counties' Local Emergency Planning Committee:

> Revise your emergency response plan to incorporate information about the capabilities and use of Operation Respond Emergency Information System software. (R-99-7)
>
> Include, in your periodic disaster drills, exercises designed to familiarize emergency responders with the capabilities and use of Operation Respond Emergency Information System software. (R-99-8)
>
> Include in your periodic disaster drills all emergency response agencies within your jurisdiction, including the Ohio River Road Volunteer Fire Department, and ensure that those agencies are aware of Cabell and Wayne Counties' emergency response plan and its implementation. (R-99-9)
>
> In cooperation with CSX Transportation, Inc., develop and implement incident coordination procedures that will ensure that safety-critical operations during wreckage-clearing activities are coordinated with all parties involved in those activities. (R-99-10)

Also, the Safety Board issued Safety Recommendations R-99-3 to the Federal Railroad Administration; R-99-4 through -6 to CSX Transportation, Inc.; and R-99-11 to Mountaineer Gas Company.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-99-7 through -10 in your reply. If you need additional information, you may call 202-314-6435.

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[2] See National Response Team Incident Command Technical Assistance Document: *Managing Response to Oil Discharge and Hazardous Substances Under the National Contingency Plan*, published by the National Response Team, May 1996. (Available at http://www.nrt.org)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: JUL 16 1999

In reply refer to: R-99-11

Mr. Michael S. Fletcher
President
Mountaineer Gas Company
414 Summer Street
Charleston, West Virginia 25301

About 12:37 p.m. eastern daylight time on Saturday, June 20, 1998, 30 of the 148 cars making up eastbound CSX train Q316 derailed at Cox Landing, West Virginia. Of the derailed cars, three were loaded with hazardous material, and eight others contained hazardous material residue. Two of the loaded cars were damaged in the pileup and leaked a combined volume of about 21,500 gallons of formaldehyde solution. No one was injured during the derailment of the train; however, 15 persons reported minor injuries as a result of the release of formaldehyde. Total damages in the accident exceeded $2.6 million.[1]

In the accident, a derailed car struck the vertical riser on a residential gas meter located within 40 feet of the centerline of the tracks. Damage to the riser resulted in a gas leak that lasted for several hours. Gas service personnel were called, but they were not allowed to approach the damaged riser because of concern that the chlorine tank cars might also be leaking. However, because of concern about the gas leak itself, the incident commander directed gas company employees to shut off gas service in the immediate area at the site.

Without access to shut-off valves at the site, gas company employees were unable to repair the damaged riser or isolate the 2-inch line. As an alternative, pipeline personnel considered isolating the 6-inch gas main by closing shutoff valves, but they were concerned about the large number of residential and industrial customers that would be affected. In any event, because of the location of the valves and the pressure and volume of gas in the line, blocking the 6-inch line would not have immediately stopped the leak.

The incident commander eventually allowed the gas service crew to access the damaged riser and determine if the 2-inch service line could be shut down. Following their inspection, the service crew capped the 2-inch service line, but the line remained charged with pressurized gas, since the line had not been isolated from the 6-inch main supply line.

[1] For more information, read Railroad Accident Report—*Derailment of a CSX Freight Train and Subsequent Hazardous Material Release at Cox Landing, West Virginia, June 20, 1998* (NTSB/RAR-99/01).

Because railroad and gas company personnel did not coordinate their activities before railroad contractors began working in the area of the gas line, railroad contractors did not know that the gas line was still charged. They stated that, had they known, they would not have carried out the wreckage-clearing operations the next day that severed the gas line and created a second gas leak in the area. This released gas, if ignited, could have injured nearby recovery workers and destroyed or damaged property. Although the gas did not ignite, its release posed a safety hazard to those in the area. The Safety Board concluded that railroad wreckage-clearing operations and pipeline operations were not effectively coordinated and unified under an effective command structure,[2] which placed excavation personnel at risk while they worked in the vicinity of a natural gas line. A unified incident command structure would have ensured better commitment from railroad, pipeline, and public safety officials in decision-making throughout the emergency response, wreckage-clearing, and environmental remediation activities.

The National Transportation Safety Board therefore makes the following safety recommendation to Mountaineer Gas Company:

> In cooperation with CSX Transportation, Inc., develop and implement incident coordination procedures that will ensure that safety-critical operations during wreckage-clearing activities are coordinated with all parties involved in those activities. (R-99-11)

Also, the Safety Board issued Safety Recommendations R-99-3 to the Federal Railroad Administration; R-99-4 thorough -6 to CSX Transportation, Inc.; and R-99-7 through -10 to Cabell and Wayne Counties' Local Emergency Planning Committee.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation R-99-11 in your reply. If you need additional information, you may call 202-314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall
Chairman

[2] See National Response Team Incident Command Technical Assistance Document: *Managing Response to Oil Discharge and Hazardous Substances Under the National Contingency Plan*, published by the National Response Team, May 1996. (Available at http://www.nrt.org)

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-12 through -14

Honorable Jolene M. Molitoris
Administrator
Federal Railroad Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of $264,000 ($187,000 to equipment, $18,000 to track and signals, and $59,000 to cargo). Conrail estimated total damages of $352,200 ($314,000 to equipment, $33,500 to track and signals, and $4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this

[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

The investigation found that Norfolk Southern's oversight of student engineers during the on-the-job portion of training is inadequate. The student engineer had not been evaluated on his performance by a qualified engineer or road foreman since completing the classroom portion of locomotive engineer training. During the accident trip, the student engineer was not supervised by a coach-trained engineer and was unaware that because of this, he should not have operated the train. In addition, the investigation found that the classroom portion of Norfolk Southern's engineer training program was not adequate to prepare student engineers to cope with all known or anticipated operational requirements systemwide, such as operating trains with the long hood forward. Safety Board interviews with the student revealed that the student engineer had not been trained in long-hood-forward operation, a configuration that significantly limits an engineer's view; in fact, the first time he had ever operated a locomotive in this configuration was the day before the accident.

The Safety Board also found that cab discipline, crew coordination, and communication were inadequate in the events leading up to the accident. The student engineer was not adequately supervised or instructed; further, the crewmembers' actions neither promoted compliance with the operating rules nor provided a positive model for the student engineer to emulate. For instance, contrary to operating rule 34, the engineer and conductor did not call clear signals. In addition, based on the statements of the engineer and the student engineer, all crewmember communication ceased well before the train approached the interlocking at Butler. In fact, for at least 30 minutes before the accident, the student engineer operated the train independently of the engineer and conductor. Moreover, he could not utilize their experience to help determine his location until just before the train was placed into emergency braking because he had not been provided strategies for dealing with crewmembers who disregard carrier rules and procedures. Norfolk Southern stated that student engineers could contact the dispatcher or road foreman to report problems such as the ones that occurred during the accident trip. However, an employee, particularly a trainee eager to gain operational experience, may be reluctant to challenge or report fellow crewmembers. The Safety Board concluded that Norfolk Southern lacks adequate safeguards to prevent student engineers from being placed in untenable situations in which rules and procedures are disregarded.

Effective crew coordination and communication are imperative, especially when a crewmember is receiving on-the-job training. One method of improving crew coordination and communication is through training. The Safety Board has long been a proponent of crew resource management (CRM) training in the aviation community and bridge resource management (BRM) training in the marine community. The goals of CRM and BRM are similar in that they promote safe operations by emphasizing the efficient use of all resources to achieve and maintain better coordination of activities. CRM and BRM training addresses critical areas, including:

- crewmember proficiency,
- situational awareness,

- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority.

The principles of CRM and BRM could be used to develop train crew resource management (TCRM) training for the railroad industry. The Safety Board has investigated several railroad accidents[2] that occurred because of inadequate communication, lack of discipline, and crewmembers' failure to function collectively as a team. In 1996, the Safety Board became aware of training developed by and for railroad employees of the former Southern Pacific Railroad (now Union Pacific) and modeled after the training provided to crewmembers at American Airlines. Union Pacific continues to provide this training to its employees and, since late 1998, has required all newly hired employees to receive it. Contact with several other Class I railroads revealed that they are not providing TCRM training. The Safety Board is not aware that the Federal Railroad Administration has demonstrated an interest in exploring and developing TCRM principles and training for the industry. The Safety Board concluded that this and other accidents investigated by the Safety Board demonstrate that railroad safety would be enhanced if crewmembers received TCRM training.

An additional concern identified during the accident investigation involved the functioning of signal 111, the signal that was missed by the Norfolk Southern crewmembers. Signal 111 was observed going dark at random intervals during the postaccident investigation; consequently, the Electro Code 4 unit containing the lighting module was removed and bench tested. Bench tests identified failed internal aluminum electrolytic capacitors that caused the signal to go dark for 10 to 24 seconds. The investigation revealed that the Norfolk Southern signal maintainer, after investigating the February and March 1998 reports of dark signal occurrences, reported to the Norfolk Southern dispatching center that intermediate signal 111 was working properly. The signal maintainer also informed the dispatching center that the signal would be monitored again. During interviews, the signal maintainer explained that monitoring consisted of acquiring downloads from the signal data recorder and examining the logs. However, no followup downloads were performed after either dark signal report. Adequate followup was crucial in the case of signal 111 because routine troubleshooting by a signal maintainer would not have identified the failed capacitors; they are on an electronic unit that a signal maintainer would not normally access. The Safety Board concluded that the Norfolk Southern Lake Division dispatching center lacked an effective procedure for identifying reported signal malfunctions of undetermined causes for further monitoring. The Safety Board further concluded that had Norfolk Southern's maintenance program responded to and corrected the twice-reported signal deficiencies at signal 111, the signal would not have continued to go dark intermittently.

Electro Code 4 units, such as the one at signal 111, determine which aspects to display from the codes received from the tracks. These units supply energy to illuminate the signal lamps

[2] Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM); Railroad Accident/Incident Summary Report—*Derailment of Amtrak Train 87, Silver Meteor, in Palatka, Florida, on December 17, 1991* (NTSB/RAR-93/02/SUM); and Railroad Accident Report—*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29, near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02).

directly and cause all lamps to go dark if internal self-tests and microprocessor operations detect a loss or perceived loss of control over the lamp output. The voltage to the lamps ceases until the failure condition is corrected.

Field inspections of other Harmon Electro-Code 4 units in the Lake Division found evidence of capacitor failures on the 212A modules manufactured from 1987 to 1988. On May 15, 1998, Harmon Industries issued a product improvement announcement detailing the failure of the capacitor and explaining how to exchange the 212A module for a replacement. By the time Harmon issued this announcement, the faulty unit at signal 111 had been replaced. The company also offered components and modification instructions to railroads preferring to and capable of making their own modifications.

Harmon Industries provided field technicians to aid Norfolk Southern in a systemwide program to identify and replace all modules manufactured from 1987 to 1988. During Safety Board depositions held in October 1998, Norfolk Southern Signal Department officials stated this program was complete for all Norfolk Southern divisions.

However, the Harmon components still have the potential to cause signal problems on other railroads. Harmon Industries estimates that of the Electro Code 4 units manufactured from 1987 to 1988, approximately 25,000 are currently installed on the nation's railroads. The Safety Board concluded that although the product improvement announcement issued by Harmon Industries addresses the capacitor problem, replacement of the capacitors is not just an improvement but needs to be made a requirement for the safe operation of Electro Code 4 units.

Therefore, the National Transportation Safety Board recommends that the Federal Railroad Administration:

> Review Norfolk Southern's 49 *Code of Federal Regulations* 240 submission, *Certification of Locomotive Engineers*, specifically "Section 5: Training, Testing, and Evaluating Persons Not Previously Certified," to determine whether the company's training program is adequate for training new engineers and require that any deficiencies found be corrected. (R-99-12)
>
> In cooperation with Class I railroads, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, and the United Transportation Union, develop and require, for all crewmembers, crew resource management training that addresses, at a minimum:
>
> - crewmember proficiency,
> - situational awareness,
> - effective communication and teamwork, and
> - strategies for appropriately challenging and questioning authority. (R-99-13)

Direct Harmon Industries and the railroad carriers to identify and replace all faulty Electro Code 4 capacitors. Ensure, through followup inspections, that corrective actions have been taken. (R-99-14)

The Safety Board also issued recommendations to Norfolk Southern Corporation, the Class I railroads and Amtrak, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, the United Transportation Union, Harmon Industries, and the DeKalb County Emergency Management Agency. Please refer to Safety Recommendations R-99-12 through -14 in your reply.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in these recommendations. Member HAMMERSCHMIDT concurred, in part, with these recommendations. (For further information, see Member HAMMERSCHMIDT's concurring and dissenting opinion in the published report referenced on page 1 of this letter.)

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-15 through -24

Mr. David R. Goode
Chairman, President, and Chief Executive Officer
Norfolk Southern Corporation
Three Commercial Place
Norfolk, Virginia 23510-9227

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of $264,000 ($187,000 to equipment, $18,000 to track and signals, and $59,000 to cargo). Conrail estimated total damages of $352,200 ($314,000 to equipment, $33,500 to track and signals, and $4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this

[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

The Safety Board believes that this accident could have been avoided had the conductor and engineer complied with Norfolk Southern rules and instructions to include: observing and confirming all signal aspects; actively supervising the student engineer, particularly one who was unfamiliar with the territory; and not reading or engaging in other distracting activities.

According to Norfolk Southern operating rule 601, engineers are responsible for train handling and care of the equipment and, by extension, for a student's operation of the train. According to operating rule 581, conductors are in charge of all train crewmembers and are responsible for enforcing rules and instructions. The investigation found that during the accident trip, the student engineer was not adequately supervised or instructed; further, the crewmembers' actions neither promoted compliance with the operating rules nor provided a positive model for the student engineer to emulate. In light of this, the Safety Board concluded that the engineer, as the individual responsible for train handling and care, and the conductor, as the individual responsible for ensuring that rules and instructions are followed, disregarded their responsibilities during the accident trip.

Another compliance issue that was pivotal to this accident concerns operating rule 34. According to testimony by both the engineer and the student engineer, the conductor stated it was crew practice not to call clear signals, an instruction that company officials stated is in violation of the rule 34 requirement to call all signals. Had the conductor and engineer called the clear signal at MP 108.4 in compliance with Norfolk Southern operating rule 34, their attention would have been engaged before the accident. Calling the signal, in turn, would have set the stage for the train either to prepare to stop in response to an approach signal in accordance with rule 285 or to stop in response to a dark signal in accordance with rule 27, which requires that a dark signal be treated as the most restrictive indication possible. The Safety Board concluded that because of the engineer's and conductor's lack of vigilance and decision not to call clear signals, the crew of Norfolk Southern train 255L5 failed to react to either an approach or a possible dark signal at MP 111.

The Norfolk Southern Lake Division had a sufficient record for conducting tests and observations for operating rule compliance, including rule 34 compliance, and reported a low failure rate during testing. But such data may be misleading because a supervisor must be on board the train and witness noncompliance for a failure to result. That the train crew could routinely ignore this operating rule, despite the Lake Division's conscientious testing and observation program and even after the conductor had received a letter of reprimand within a year of the accident for violating that operating rule, strongly argues that an operating rule alone will not guarantee that signals are called.

Unlike Norfolk Southern, which does not maintain a record of in-cab communication of signals, two other railroads, the Burlington Northern Santa Fe Railway Company (BNSF) and the Union Pacific Railroad (UP), require that signal aspects, time, and speed be noted on a form. The BNSF requires that these forms be submitted at the end of each trip as directed by the applicable

division superintendent. The UP requires that conductors maintain the forms for five trips and keep them in their possession while on duty.

The railroad industry already has requirements for recording crewmember actions or events during a trip, such as those for drug and alcohol testing under 49 CFR 219 and the use of event recorders under 49 CFR 229.135. These measures provide an after-the-fact record, reinforcing desired behavior by ensuring crewmember accountability. In addition, tasking crewmembers to keep a record of signals observed would enhance train crew coordination by ensuring that crewmembers communicate during a trip. The Safety Board concluded that having procedures to actively engage crewmembers in observing and confirming all signal aspects, such as recording the aspects, would make it more likely that train crews call signals in compliance with the operating rules.

The investigation also found that Norfolk Southern's oversight of student engineers during the on-the-job portion of training is inadequate. The student engineer had not been evaluated on his performance by a qualified engineer or road foreman since completing the classroom portion of locomotive engineer training. During the accident trip, the student engineer was not supervised by a coach-trained engineer and was unaware that because of this, he should not have operated the train.

The Safety Board evaluated the effectiveness of the on-the-job portion of Norfolk Southern's locomotive engineer training program principally in the context of the relationship between the student engineer and the engineer. During the accident trip and during the preceding trip from Peru to Detroit, the student engineer did not follow company policy by failing to ascertain whether the engineer was coach trained. That a student engineer was ultimately paired with an engineer who was not coach trained clearly illustrates that despite the company's assertion to the contrary, Norfolk Southern procedures designed to prevent such situations have not worked.

The Safety Board determined that the training requirements form noting the restrictions on student engineers and signed by the student engineer on March 3, 1998, while developed and deemed appropriate for student engineers assigned to the Lake Division, was not being used systemwide. The System Road Foreman of Engines stated that the form was unique to the Lake Division and that other divisions used similar forms or dispensed similar information orally. The Safety Board concluded that allowing local variations in training requirements promotes operational inconsistencies and hinders uniform compliance with the student engineer training program.

Because Norfolk Southern provided information on the student engineer program to coach-trained engineers only and, in the Lake Division at the time of the accident, relied on student engineers to inform engineers of operating restrictions, it is unlikely that the engineer would have known that the student should not operate the train. According to the Division Road Foreman of Engines, a Superintendent's Notice was issued after the accident informing all Lake Division personnel of operating restrictions on student engineers. The Safety Board concluded that unless all Norfolk Southern operating personnel are informed of restrictions on the operation

of trains by student engineers, a situation in which a student engineer operates a train without proper supervision could occur again.

Furthermore, the Safety Board is concerned that when the student engineer returned to the Lake Division, he received no feedback on his performance. The fact that the student received no oral or written feedback during this phase of his training is additional evidence that the locomotive engineer training program at the time of this accident was inadequate. The Safety Board regards timely feedback as an essential element in any training program for achieving and maintaining desired behavior consistent with stated policy; inadequate or no feedback degrades the training experience. Performance feedback, whether by a qualified engineer or a road foreman, should occur throughout the training process. The Safety Board concluded that not providing feedback because the student engineer had not yet reached the point at which he was scheduled to be formally evaluated by a road foreman (that is, he had not worked in the Lake Division for 1 month) is inconsistent with the goals of effective training.

The Safety Board evaluated the effectiveness of the classroom portion of Norfolk Southern's locomotive engineer training program principally in the context of whether the training adequately prepared the student for operational situations encountered during the accident trip. The investigation revealed that the student engineer had not been trained to operate a locomotive in the long-hood-forward configuration; in fact, the first time he had ever operated a locomotive in this configuration was the day before the accident.

Norfolk Southern Training Center personnel indicated that locomotive engineer training includes the fundamental concepts of locomotive and train operations. Classroom and laboratory activities are combined with daily hands-on simulated train operations using one full-motion and two stationary locomotive simulators. All three simulators are configured with the "short nose forward"; consequently, the view from the simulator is significantly less restricted than the view the student engineer had during the accident trip. Training Center personnel said that while students in training at McDonough may have the opportunity to operate a locomotive in the long-hood-forward configuration on the school's training track, the division is responsible for training student engineers on operational variations and conditions unique to the division, including operating locomotives in the long-hood-forward configuration.

The Safety Board disagrees with this approach to engineer training. An adequate training program should address all known or anticipated operational requirements systemwide. The idea that training should address operational requirements systemwide is particularly relevant considering the local variations in student engineer training requirements that were discussed earlier in this letter. By delegating selected aspects of operational training to the divisions, the locomotive engineer training program does not equally prepare student engineers for situations encountered on the job. The Safety Board concluded that Norfolk Southern's engineer training program was not adequate to prepare student engineers to cope with all known or anticipated operational requirements systemwide, such as operating trains with the long hood forward.

The Safety Board considers aggressive oversight to be essential to any program, but particularly to a training program, because such oversight promotes compliance with company policy. The lack of oversight in this accident is particularly relevant considering the training

improvements that Norfolk Southern stated it implemented after a strikingly similar accident near Knox, Indiana, in 1991.[2] As was the case in this accident, the Knox investigation found deficiencies in crew coordination, communication, and cab discipline, prompting the Safety Board to make the following recommendation to Norfolk Southern:

> R-92-09
>
> Review and revise your programs for traincrew supervision, locomotive cab discipline, and training of student engineers in light of the circumstances of this accident, and make necessary improvements.

In December 1992, the Safety Board classified this recommendation "Closed—Acceptable Action," based on the company's response that it had revised its training to emphasize the understanding of and compliance with operating rules and to emphasize the engineer's responsibility for safe and effective train handling. However, the circumstances of the Butler accident led the Safety Board to determine that Norfolk Southern's locomotive engineer training program is inadequate; therefore, the company must explore additional ways to improve engineer training, both in the classroom and the field.

When a crewmember is receiving on-the-job training, effective crew coordination and communication are imperative. Based on the statements of the engineer and the student engineer, all crewmember communication ceased well before the train approached the interlocking at Butler. In fact, for at least 30 minutes before the accident, the student engineer operated the train independently of the engineer and conductor. Moreover, he could not utilize their experience to help determine his location until just before the train was placed into emergency braking because he had not been provided strategies for dealing with crewmembers who knowingly disregard carrier rules and procedures. Norfolk Southern stated that student engineers could contact the dispatcher or road foreman to report problems such as the ones that occurred during the accident trip. However, an employee, particularly a trainee eager to gain operational experience, may be reluctant to challenge or report fellow crewmembers. The Safety Board concluded that Norfolk Southern lacks adequate safeguards to prevent student engineers from being placed in untenable situations in which rules and procedures are disregarded.

One method of improving crew coordination and communication is through training. The Safety Board has long been a proponent of crew resource management (CRM) training in the aviation community and bridge resource management (BRM) training in the marine community. The goals of CRM and BRM are similar in that they promote safe operations by emphasizing the efficient use of all resources to achieve and maintain better coordination of activities. CRM and BRM training addresses critical areas, including:

- crewmember proficiency,
- situational awareness,

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[2] Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM).

- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority.

The principles of CRM and BRM could be used to develop train crew resource management (TCRM) training for the railroad industry. The Safety Board has investigated several railroad accidents[3] that occurred because of inadequate communication, lack of discipline, and crewmembers' failure to function collectively as a team. In 1996, the Safety Board became aware of training developed by and for railroad employees of the former Southern Pacific Railroad (now UP) and modeled after the training provided to crewmembers at American Airlines. The UP continues to provide this training to its employees and, since late 1998, has required all newly hired employees to receive it. Contact with several other Class I railroads revealed that they are not providing TCRM training. The Safety Board is not aware that the Federal Railroad Administration has demonstrated an interest in exploring and developing TCRM principles and training for the industry. The Safety Board concluded that this and other accidents investigated by the Safety Board demonstrate that railroad safety would be enhanced if crewmembers received TCRM training.

An additional safety concern identified during the investigation was the adequacy of Norfolk Southern's signal malfunction reporting procedures, especially with respect to signal 111. Signal 111, which was missed by the Norfolk Southern crewmembers, was observed going dark at random intervals during the postaccident investigation; consequently, the Electro Code 4 unit containing the lighting module was removed and bench tested. Bench tests identified failed internal aluminum electrolytic capacitors that caused the signal to go dark for 10 to 24 seconds.

The investigation revealed that the Norfolk Southern signal maintainer, after investigating the February and March 1998 reports of dark signal occurrences, reported to the Norfolk Southern dispatching center that intermediate signal 111 was working properly. The signal maintainer also informed the dispatching center that the signal would be monitored again. During interviews, the signal maintainer explained that monitoring consisted of acquiring downloads from the signal data recorder and examining the logs. However, no followup downloads were performed after either dark signal report. Adequate followup was crucial in the case of signal 111 because routine troubleshooting by a signal maintainer would not have identified the failed capacitors; they are on an electronic unit that the signal maintainer does not normally access. The Safety Board concluded that the Norfolk Southern Lake Division dispatching center lacked an effective procedure for identifying reported signal malfunctions of undetermined causes for further monitoring. The Safety Board further concluded that had Norfolk Southern's maintenance program responded to and corrected the twice-reported signal deficiencies at signal 111, the signal would not have continued to go dark intermittently.

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[3] Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM); Railroad Accident/Incident Summary Report—*Derailment of Amtrak Train 87, Silver Meteor, in Palatka, Florida, on December 17, 1991* (NTSB/RAR-93/02/SUM); and Railroad Accident Report—*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29, near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02).

The majority of Class I railroad dispatching centers have full-time signal personnel working in their dispatching centers to handle all signal and grade crossing malfunction reports. The dispatchers forward such reports to these representatives, who record and track the status of the malfunctions and notify the necessary signal maintenance personnel to investigate and repair them. Having personnel technically knowledgeable in signal systems aids in prioritizing the investigation and repair of malfunctions that require immediate attention. Designated personnel, not tasked with dispatching trains, can also better and more thoroughly identify and track locations that have repeated malfunction reports and ensure that all available tools are used to repair the malfunctions and maintain the proper level of safety.

Another safety concern identified during the accident investigation involved the identification and emergency response management of hazardous materials. Because a white powder that had been spilled by the Norfolk Southern train as a result of the collision was potentially hazardous, the DeKalb County Hazardous Materials Response Plan was initially activated for a level 3 response, resulting in two schools being closed.

When the two surviving Norfolk Southern crewmembers were unable to furnish the Butler fire department with a train consist listing the materials transported on the Norfolk Southern train, emergency responders donned self-contained breathing apparatus to collect information from one of the broken bags of white powder. The fire chief then attempted to contact the manufacturer. Because the accident occurred during nonbusiness hours, a cleaning person answered the telephone and provided the name of the only chemical manufactured by the company, nepheline syenite. (The cleaning person's information was later confirmed by company personnel during business hours.) The fire chief contacted CHEMTREC (Chemical Transportation Emergency Center), which confirmed that nepheline syenite is not a hazardous material. After about an hour, when the white powder had been identified as a nonhazardous material, the incident was downgraded to a level 2 response because of the diesel fuel on the ground.

The Safety Board has long been concerned about the emergency response management of railroad accidents involving hazardous materials. The Board, in its 1991 safety study[4] on transporting hazardous materials by rail, discussed how the lack of coordination between the railroads and communities on emergency response planning had presented major safety problems in nine accidents and incidents investigated between 1977 and 1987. The Safety Board subsequently issued the following recommendation to the Class I railroads:

> R-91-15
>
> Develop, implement, and keep current, in coordination with communities adjacent to your railroad yards and along your hazardous materials routes, written emergency response plans and procedures for handling releases of hazardous materials. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed

[4] Safety Study—*Transport of Hazardous Materials by Rail* (NTSB/SS-91/01).

during the response effort, procedures for coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other appropriate methods to test emergency response plans.

In December 1991, the Safety Board classified Safety Recommendation R-91-15 "Closed—Acceptable Action," based upon Norfolk Southern's initial response in July 1991 and subsequent November 1, 1991, letter that emergency response procedures had been developed and were being implemented. The November 1, 1991, letter noted that Norfolk Southern directs its emergency response coordination efforts toward all of the communities along its service routes, not just those with rail yards, to include sharing hazardous material response plans with localities, providing training for the smaller cities and towns along its routes, and providing personnel to serve on local emergency planning committees.

However, according to the Norfolk Southern Lake Division Supervisor, DeKalb County was not on the list of communities trained recently by Norfolk Southern in emergency response coordination. In this accident, local officials did not attempt to contact the railroad for assistance beyond asking the surviving Norfolk Southern crewmembers what substance the Norfolk Southern train carried. The company's lack of coordination with the community resulted in emergency response personnel taking an hour to identify a potentially hazardous substance and in two schools being closed unnecessarily. The Safety Board concluded that better coordination by Norfolk Southern with DeKalb County may have prevented the delay in identifying the possibly hazardous material transported on the Norfolk Southern train.

In the Safety Board's opinion, such a situation is unacceptable, considering that more than 7 years have passed since Norfolk Southern stated it would coordinate emergency response plans with the communities along its service routes. The Safety Board is concerned that other communities may be exposed to similar risks from hazardous material releases and other rail emergencies because Norfolk Southern has not followed through on emergency response coordination.

Therefore, the National Transportation Safety Board recommends that Norfolk Southern Corporation:

Develop and implement methods to improve employee compliance with company rules and instructions. (R-99-15)

Develop and implement procedures that actively engage crewmembers in observing and confirming all signal aspects. (R-99-16)

Inform all operating personnel of their responsibilities regarding student engineers. (R-99-17)

Assign supervisors dedicated exclusively to student engineers who will, at a minimum:

- meet with student engineers at the start of the on-the-job training phase to ensure that student engineers are aware of the conditions under which they can operate a train and that they know what to do if these conditions are not met;
- track the student engineer's daily train assignments, daily crew assignments, and performance evaluations; and
- provide timely feedback and advice to student engineers on a continuing basis. (R-99-18)

Provide student engineers with formal training in all known or anticipated operational requirements systemwide, including operating trains with the long hood forward. (R-99-19)

Conduct a comprehensive assessment of the locomotive engineer training program and revise it, as necessary, to ensure that student engineers consistently operate with and are mentored by coach-trained engineers and that engineer training reflects actual operating conditions. (R-99-20)

Provide employees, especially trainees, with effective strategies for dealing with crewmembers who knowingly disregard the operating rules. (R-99-21)

In cooperation with the Federal Railroad Administration, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, and the United Transportation Union, develop, for all train crewmembers, crew resource management training that addresses at a minimum:

- crewmember proficiency,
- situational awareness,
- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority. (R-99-22)

Designate dedicated personnel to record and track all signal malfunctions and repairs in order to identify recurring, unresolved failures. (R-99-23)

Conduct an audit to identify all communities through which you transport hazardous materials and, in coordination with those communities, develop, implement, and keep current written emergency response plans and procedures for handling hazardous material releases. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical

assistance that may be needed during the response effort, procedures for the coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other methods to test emergency response plans. (R-99-24)

The Safety Board also issued recommendations to the Federal Railroad Administration, the Class I railroads and Amtrak, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, the United Transportation Union, Harmon Industries, and the DeKalb County Emergency Management Agency.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-99-15 through -24 in your reply. If you need additional information, you may call (202) 314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in these recommendations. Member HAMMERSCHMIDT concurred, in part, with these recommendations. (For further information, see Member HAMMERSCHMIDT's concurring and dissenting opinion in the published report referenced on page 1 of this letter.)

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-25

Class I Railroads and Amtrak
(See attached list.)

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of $264,000 ($187,000 to equipment, $18,000 to track and signals, and $59,000 to cargo). Conrail estimated total damages of $352,200 ($314,000 to equipment, $33,500 to track and signals, and $4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

The Safety Board found that cab discipline, crew coordination, and communication were inadequate in the events leading up to the accident. The student engineer was not adequately supervised or instructed; further, the crewmembers' actions neither promoted compliance with the operating rules nor provided a positive model for the student engineer to emulate. For instance, contrary to operating rule 34, the engineer and conductor did not call clear signals. In addition, based on the statements of the engineer and the student engineer, all crewmember communication ceased well before the train approached the interlocking at Butler. In fact, for at least 30 minutes before the accident, the student engineer operated the train independently of the engineer and conductor. Moreover, he could not utilize their experience to help determine his location until just before the train was placed into emergency braking because he had not been provided strategies for dealing with crewmembers who knowingly disregard carrier rules and procedures. Norfolk Southern stated that student engineers could contact the dispatcher or road foreman to report problems such as the ones that occurred during the accident trip. However, an employee, particularly a trainee eager to gain operational experience, may be reluctant to challenge or report fellow crewmembers.

Effective crew coordination and communication are imperative, especially when a crewmember is receiving on-the-job training. One method of improving crew coordination and communication is through training. The Safety Board has long been a proponent of crew resource management (CRM) training in the aviation community and bridge resource management (BRM) training in the marine community. The goals of CRM and BRM are similar in that they promote safe operations by emphasizing the efficient use of all resources to achieve and maintain better coordination of activities. CRM and BRM training addresses critical areas, including:

- crewmember proficiency,
- situational awareness,
- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority.

The principles of CRM and BRM could be used to develop train crew resource management (TCRM) training for the railroad industry. The Safety Board has investigated several railroad accidents[2] that occurred because of inadequate communication, lack of discipline, and crewmembers' failure to function collectively as a team. In 1996, the Safety Board became aware of training developed by and for railroad employees of the former Southern Pacific Railroad (now Union Pacific) and modeled after the training provided to crewmembers at American Airlines. Union Pacific continues to provide this training to its employees and, since late 1998, has required all newly hired employees to receive it. Contact with several other Class I

[2] Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM); Railroad Accident/Incident Summary Report—*Derailment of Amtrak Train 87, Silver Meteor, in Palatka, Florida, on December 17, 1991* (NTSB/RAR-93/02/SUM); and Railroad Accident Report—*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29, near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02).

railroads revealed that they are not providing TCRM training. The Safety Board is not aware that the Federal Railroad Administration has demonstrated an interest in exploring and developing TCRM principles and training for the industry.

The Safety Board concluded that this and other accidents investigated by the Safety Board demonstrate that railroad safety would be enhanced if crewmembers received TCRM training. Therefore, the National Transportation Safety Board recommends that the Class I railroads and Amtrak:

> In cooperation with the Federal Railroad Administration, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, and the United Transportation Union, develop, for all train crewmembers, train crew resource management training that addresses, at a minimum:
>
> - crewmember proficiency,
> - situational awareness,
> - effective communication and teamwork, and
> - strategies for appropriately challenging and questioning authority. (R-99-25)

The Safety Board also issued recommendations to the Federal Railroad Administration, Norfolk Southern Corporation, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, the United Transportation Union, Harmon Industries, and the DeKalb County Emergency Management Agency.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation R-99-25 in your reply. If you need additional information, you may call (202) 314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in this recommendation. Member HAMMERSCHMIDT concurred, in part, with this recommendation. (For further information, see Member HAMMERSCHMIDT's concurring and dissenting opinion in the published report referenced on page 1 of this letter.)

By: Jim Hall
Chairman

Class I railroads and Amtrak:

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Mr. Richard K. Davidson
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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-26

Mr. Frank K. Turner
President
American Short Line and Regional Railroad Association
1120 G Street, N.W., Suite 520
Washington, D.C. 20005-3889

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

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[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

The Safety Board found that cab discipline, crew coordination, and communication were inadequate in the events leading up to the accident. The student engineer was not adequately supervised or instructed; further, the crewmembers' actions neither promoted compliance with the operating rules nor provided a positive model for the student engineer to emulate. For instance, contrary to operating rule 34, the engineer and conductor did not call clear signals. In addition, based on the statements of the engineer and the student engineer, all crewmember communication ceased well before the train approached the interlocking at Butler. In fact, for at least 30 minutes before the accident, the student engineer operated the train independently of the engineer and conductor. Moreover, he could not utilize their experience to help determine his location until just before the train was placed into emergency braking because he had not been provided strategies for dealing with crewmembers who knowingly disregard carrier rules and procedures. Norfolk Southern stated that student engineers could contact the dispatcher or road foreman to report problems such as the ones that occurred during the accident trip. However, an employee, particularly a trainee eager to gain operational experience, may be reluctant to challenge or report fellow crewmembers.

Effective crew coordination and communication are imperative, especially when a crewmember is receiving on-the-job training. One method of improving crew coordination and communication is through training. The Safety Board has long been a proponent of crew resource management (CRM) training in the aviation community and bridge resource management (BRM) training in the marine community. The goals of CRM and BRM are similar in that they promote safe operations by emphasizing the efficient use of all resources to achieve and maintain better coordination of activities. CRM and BRM training addresses critical areas, including:

- crewmember proficiency,
- situational awareness,
- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority.

The principles of CRM and BRM could be used to develop train crew resource management (TCRM) training for the railroad industry. The Safety Board has investigated several railroad accidents[2] that occurred because of inadequate communication, lack of discipline, and crewmembers' failure to function collectively as a team. In 1996, the Safety Board became aware of training developed by and for railroad employees of the former Southern

[2] Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM); Railroad Accident/Incident Summary Report—*Derailment of Amtrak Train 87, Silver Meteor, in Palatka, Florida, on December 17, 1991* (NTSB/RAR-93/02/SUM); and Railroad Accident Report—*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29, near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02).

Pacific Railroad (now Union Pacific) and modeled after the training provided to crewmembers at American Airlines. Union Pacific continues to provide this training to its employees and, since late 1998, has required all newly hired employees to receive it. Contact with several other Class I railroads revealed that they are not providing TCRM training. The Safety Board is not aware that the Federal Railroad Administration has demonstrated an interest in exploring and developing TCRM principles and training for the industry.

The Safety Board concluded that this and other accidents investigated by the Safety Board demonstrate that railroad safety would be enhanced if crewmembers received TCRM training. Therefore the Safety Board recommends that the American Short Line and Regional Railroad Association:

> In cooperation with the Federal Railroad Administration, the Class I railroads, the Brotherhood of Locomotive Engineers, and the United Transportation Union, develop, for all train crewmembers, train crew resource management training that addresses, at a minimum:
>
> - crewmember proficiency,
> - situational awareness,
> - effective communication and teamwork, and
> - strategies for appropriately challenging and questioning authority. (R-99-26)

The Safety Board also issued recommendations to the Federal Railroad Administration, Norfolk Southern Corporation, the Class I railroads and Amtrak, the Brotherhood of Locomotive Engineers, the United Transportation Union, Harmon Industries, and the DeKalb County Emergency Management Agency.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation R-99-26 in your reply. If you need additional information, you may call (202) 314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in this recommendation. Member HAMMERSCHMIDT concurred, in part, with this recommendation. (For further information, see Member HAMMERSCHMIDT's concurring and dissenting opinion in the published report referenced on page 1 of this letter.)

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-27

Mr. Clarence Monin
International President
Brotherhood of Locomotive Engineers
Standard Building
1370 Ontario Street
Cleveland, Ohio 44113-1702

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of $264,000 ($187,000 to equipment, $18,000 to track and signals, and $59,000 to cargo). Conrail estimated total damages of $352,200 ($314,000 to equipment, $33,500 to track and signals, and $4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this

[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

The Safety Board found that cab discipline, crew coordination, and communication were inadequate in the events leading up to the accident. The student engineer was not adequately supervised or instructed; further, the crewmembers' actions neither promoted compliance with the operating rules nor provided a positive model for the student engineer to emulate. For instance, contrary to operating rule 34, the engineer and conductor did not call clear signals. In addition, based on the statements of the engineer and the student engineer, all crewmember communication ceased well before the train approached the interlocking at Butler. In fact, for at least 30 minutes before the accident, the student engineer operated the train independently of the engineer and conductor. Moreover, he could not utilize their experience to help determine his location until just before the train was placed into emergency braking because he had not been provided strategies for dealing with crewmembers who knowingly disregard carrier rules and procedures. Norfolk Southern stated that student engineers could contact the dispatcher or road foreman to report problems such as the ones that occurred during the accident trip. However, an employee, particularly a trainee eager to gain operational experience, may be reluctant to challenge or report fellow crewmembers.

Effective crew coordination and communication are imperative, especially when a crewmember is receiving on-the-job training. One method of improving crew coordination and communication is through training. The Safety Board has long been a proponent of crew resource management (CRM) training in the aviation community and bridge resource management (BRM) training in the marine community. The goals of CRM and BRM are similar in that they promote safe operations by emphasizing the efficient use of all resources to achieve and maintain better coordination of activities. CRM and BRM training addresses critical areas, including:

- crewmember proficiency,
- situational awareness,
- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority.

The principles of CRM and BRM could be used to develop train crew resource management (TCRM) training for the railroad industry. The Safety Board has investigated several railroad accidents[2] that occurred because of inadequate communication, lack of discipline, and crewmembers' failure to function collectively as a team. In 1996, the Safety Board became aware of training developed by and for railroad employees of the former Southern

[2] Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM); Railroad Accident/Incident Summary Report—*Derailment of Amtrak Train 87, Silver Meteor, in Palatka, Florida, on December 17, 1991* (NTSB/RAR-93/02/SUM); and Railroad Accident Report—*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29, near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02).

Pacific Railroad (now Union Pacific) and modeled after the training provided to crewmembers at American Airlines. Union Pacific continues to provide this training to its employees and, since late 1998, has required all newly hired employees to receive it. Contact with several other Class I railroads revealed that they are not providing TCRM training. The Safety Board is not aware that the Federal Railroad Administration has demonstrated an interest in exploring and developing TCRM principles and training for the industry.

The Safety Board concluded that this and other accidents investigated by the Safety Board demonstrate that railroad safety would be enhanced if crewmembers received TCRM training. Therefore, the National Transportation Safety Board recommends that the Brotherhood of Locomotive Engineers:

> In cooperation with the Federal Railroad Administration, the Class I railroads, the American Short Line and Regional Railroad Association, and the United Transportation Union, develop, for all train crewmembers, train crew resource management training that addresses, at a minimum:
>
> - crewmember proficiency,
> - situational awareness,
> - effective communication and teamwork, and
> - strategies for appropriately challenging and questioning authority. (R-99-27)

The Safety Board also issued recommendations to the Federal Railroad Administration, Norfolk Southern Corporation, the Class I railroads and Amtrak, the American Short Line and Regional Railroad Association, the United Transportation Union, Harmon Industries, and the DeKalb County Emergency Management Agency.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation R-99-27 in your reply. If you need additional information, you may call (202) 314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in this recommendation. Member HAMMERSCHMIDT concurred, in part, with this recommendation. (For further information, see Member HAMMERSCHMIDT's concurring and dissenting opinion in the published report referenced on page 1 of this letter.)

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-28

Mr. Charles L. Little
International President
United Transportation Union
14600 Detroit Avenue
Cleveland, Ohio 44107-4250

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of $264,000 ($187,000 to equipment, $18,000 to track and signals, and $59,000 to cargo). Conrail estimated total damages of $352,200 ($314,000 to equipment, $33,500 to track and signals, and $4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this

[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

The Safety Board found that cab discipline, crew coordination, and communication were inadequate in the events leading up to the accident. The student engineer was not adequately supervised or instructed; further, the crewmembers' actions neither promoted compliance with the operating rules nor provided a positive model for the student engineer to emulate. For instance, contrary to operating rule 34, the engineer and conductor did not call clear signals. In addition, based on the statements of the engineer and the student engineer, all crewmember communication ceased well before the train approached the interlocking at Butler. In fact, for at least 30 minutes before the accident, the student engineer operated the train independently of the engineer and conductor. Moreover, he could not utilize their experience to help determine his location until just before the train was placed into emergency braking because he had not been provided strategies for dealing with crewmembers who knowingly disregard carrier rules and procedures. Norfolk Southern stated that student engineers could contact the dispatcher or road foreman to report problems such as the ones that occurred during the accident trip. However, an employee, particularly a trainee eager to gain operational experience, may be reluctant to challenge or report fellow crewmembers.

Effective crew coordination and communication are imperative, especially when a crewmember is receiving on-the-job training. One method of improving crew coordination and communication is through training. The Safety Board has long been a proponent of crew resource management (CRM) training in the aviation community and bridge resource management (BRM) training in the marine community. The goals of CRM and BRM are similar in that they promote safe operations by emphasizing the efficient use of all resources to achieve and maintain better coordination of activities. CRM and BRM training addresses critical areas, including:

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The principles of CRM and BRM could be used to develop train crew resource management (TCRM) training for the railroad industry. The Safety Board has investigated several railroad accidents[2] that occurred because of inadequate communication, lack of discipline, and crewmembers' failure to function collectively as a team. In 1996, the Safety Board became aware of training developed by and for railroad employees of the former Southern

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Pacific Railroad (now Union Pacific) and modeled after the training provided to crewmembers at American Airlines. Union Pacific continues to provide this training to its employees and, since late 1998, has required all newly hired employees to receive it. Contact with several other Class I railroads revealed that they are not providing TCRM training. The Safety Board is not aware that the Federal Railroad Administration has demonstrated an interest in exploring and developing TCRM principles and training for the industry.

The Safety Board concluded that this and other accidents investigated by the Safety Board demonstrate that railroad safety would be enhanced if crewmembers received TCRM training.[Factual and analytical material leading to recommendations. Therefore, the National Transportation Safety Board recommends that the United Transportation Union:

> In cooperation with the Federal Railroad Administration, the Class I railroads, the American Short Line and Regional Railroad Association, and the Brotherhood of Locomotive Engineers, develop, for all train crewmembers, train crew resource management training that addresses, at a minimum:
>
> - crewmember proficiency,
> - situational awareness,
> - effective communication and teamwork, and
> - strategies for appropriately challenging and questioning authority. (R-99-28)

The Safety Board also issued recommendations to the Federal Railroad Administration, Norfolk Southern Corporation, the Class I railroads and Amtrak, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, Harmon Industries, and the DeKalb County Emergency Management Agency.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation R-99-28 in your reply. If you need additional information, you may call (202) 314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in this recommendation. Member HAMMERSCHMIDT concurred, in part, with this recommendation. (For further information, see Member HAMMERSCHMIDT's concurring and dissenting opinion in the published report referenced on page 1 of this letter.)

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-29

Mr. Bjorn E. Olsson
President and Chief Executive Officer
Harmon Industries
1300 Jefferson Court
Blue Springs, Missouri 64015

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of $264,000 ($187,000 to equipment, $18,000 to track and signals, and $59,000 to cargo). Conrail estimated total damages of $352,200 ($314,000 to equipment, $33,500 to track and signals, and $4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this

[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

An additional concern identified during the accident investigation involved the adequacy of Harmon Industries' signal component repair and replacement program. Signal 111, which was missed by the Norfolk Southern crewmembers, was observed going dark at random intervals during the postaccident investigation; consequently, the Electro Code 4 unit containing the lighting module was removed and bench tested. Bench tests identified failed internal aluminum electrolytic capacitors that caused the signal to go dark for 10 to 24 seconds.

Field inspections of other Harmon Electro-Code 4 units in the Lake Division found evidence of capacitor failures on the 212A modules manufactured from 1987 to 1988. On May 15, 1998, almost 2 months after the accident, Harmon Industries issued a product improvement announcement detailing the failure of the capacitor and explaining how to exchange the 212A module for a replacement. The company also offered components and modification instructions to railroads preferring to and capable of making their own modifications.

Harmon Industries provided field technicians to aid Norfolk Southern in a systemwide program to identify and replace all modules manufactured from 1987 to 1988. During Safety Board depositions held in October 1998, Norfolk Southern Signal Department officials stated this program was complete for all Norfolk Southern divisions.

Harmon Industries estimates that of the Electro Code 4 units manufactured from 1987 to 1988, approximately 25,000 are currently installed on the nation's railroads. The Safety Board concluded that although the product improvement announcement issued by Harmon Industries addresses the capacitor problem, replacement of the capacitors is not just an improvement but needs to be made a requirement for the safe operation of Electro Code 4 units. Therefore, in addition to recommending that the Federal Railroad Administration direct Harmon Industries and the railroad carriers to identify and replace all faulty Electro Code 4 capacitors and to ensure, through followup inspections, that corrective actions have been taken, the National Transportation Safety Board also recommends that Harmon Industries:

> Identify and contact all customers who purchased Electro Code 4 units manufactured from 1987 to 1988, and institute a systematic corrective program for the repair or replacement of faulty electrolytic capacitors. (R-99-29)

The Safety Board also issued recommendations to the Federal Railroad Administration, Norfolk Southern Corporation, the Class I railroads and Amtrak, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, the United Transportation Union, and the DeKalb County Emergency Management Agency.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding

action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation R-99-29 in your reply. If you need additional information, you may call (202) 314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-30

Mr. Paul Freeburn
Director of Emergency Management
DeKalb County Emergency Management Agency
215 E. 9th Street
Suite 101
Auburn, Indiana 46706

On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.[1] The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of $264,000 ($187,000 to equipment, $18,000 to track and signals, and $59,000 to cargo). Conrail estimated total damages of $352,200 ($314,000 to equipment, $33,500 to track and signals, and $4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this

[1] For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

An additional concern identified during the accident investigation involved the identification and emergency response management of hazardous materials. Because a white powder that had been spilled by the Norfolk Southern train as a result of the collision was potentially hazardous, the DeKalb County Hazardous Materials Response Plan was initially activated for a level 3 response, resulting in two schools being closed.

When the two surviving Norfolk Southern crewmembers were unable to furnish the Butler fire department with a train consist listing the materials transported on the Norfolk Southern train, emergency responders donned self-contained breathing apparatus to collect information from one of the broken bags of white powder. The fire chief then attempted to contact the manufacturer. Because the accident occurred during nonbusiness hours, a cleaning person answered the telephone and provided the name of the only chemical manufactured by the company, nepheline syenite. (The cleaning person's information was later confirmed by company personnel during business hours.) The fire chief contacted CHEMTREC (Chemical Transportation Emergency Center), which confirmed that nepheline syenite is not a hazardous material. After about an hour, when the white powder had been identified as a nonhazardous material, the incident was downgraded to a level 2 response because of the diesel fuel on the ground.

The Safety Board has long been concerned about the emergency response management of railroad accidents involving hazardous materials. The Board, in its 1991 safety study[2] on transporting hazardous materials by rail, discussed how the lack of coordination between the railroads and communities on emergency response planning had presented major safety problems in nine accidents and incidents investigated between 1977 and 1987. The Safety Board subsequently issued the following recommendation to the Class I railroads:

> R-91-15
>
> Develop, implement, and keep current, in coordination with communities adjacent to your railroad yards and along your hazardous materials routes, written emergency response plans and procedures for handling releases of hazardous materials. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, procedures for coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other appropriate methods to test emergency response plans.

[2] Safety Study—*Transport of Hazardous Materials by Rail* (NTSB/SS-91/01).

In December 1991, the Safety Board classified Safety Recommendation R-91-15 "Closed—Acceptable Action," based upon Norfolk Southern's initial response in July 1991 and subsequent November 1, 1991, letter that emergency response procedures had been developed and were being implemented. The November 1, 1991, letter noted that Norfolk Southern directs its emergency response coordination efforts toward all of the communities along its service routes, not just those with rail yards, to include sharing hazardous material response plans with localities, providing training for the smaller cities and towns along its routes, and providing personnel to serve on local emergency planning committees.

However, according to the Norfolk Southern Lake Division Supervisor, DeKalb County was not on the list of communities trained recently by Norfolk Southern in emergency response coordination. In this accident, local officials did not attempt to contact the railroad for assistance beyond asking the surviving Norfolk Southern crewmembers what substance the Norfolk Southern train carried. The company's lack of coordination with the community resulted in emergency response personnel taking an hour to identify a potentially hazardous substance and in two schools being closed unnecessarily. The Safety Board concluded that better coordination by Norfolk Southern with DeKalb County may have prevented the delay in identifying the possibly hazardous material transported on the Norfolk Southern train.

In the Safety Board's opinion, such a situation is unacceptable, considering that more than 7 years have passed since Norfolk Southern stated it would coordinate emergency response plans with the communities along its service routes. The Safety Board is concerned that other communities may be exposed to similar risks from hazardous material releases and other rail emergencies because Norfolk Southern has not followed through on emergency response coordination. Therefore, in addition to requesting that Norfolk Southern Corporation follow through on the Safety Board's 1991 recommendation, the Safety Board also recommends that the DeKalb County Emergency Management Agency:

> Contact Norfolk Southern Lake Division officials to provide and keep current, points of contact for emergency response coordination. (R-99-30)

The Safety Board also issued recommendations to the Federal Railroad Administration, Norfolk Southern Corporation, the Class I railroads and Amtrak, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, the United Transportation Union, and Harmon Industries.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation R-99-30 in your reply. If you need additional information, you may call (202) 314-6435.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall
Chairman